

OPERATING PROCEDURES FOR ANTHROPOMETRY AND INITIAL CONDITIONS PHOTOGRAMMETRIC PROGRAM

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Software Documentation

March 1994

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TABLE OF CONTENTS

Introduction	1
Function	3
ALTEK Digitizer	4
NGIANT	4
NPREP	6
Initial Conditions.	6
Head Anthropometry.	9
Body (Neck) Anthropometry.	11
Additional Information.	15
Programs	15
Subroutine Descriptions	18
Heads.	18
Body.	18
FID.	18
FOURP.	19
FIVEP.	19
SIXP.	19
EIGHTP.	19
ACCAPR.	19
ACCNEQ.	20
INVERT.	20
LINSOL.	20
CLEAR.	20
NEWPAG.	20
Giant Subroutines Customized for NAVBIODYNLAB	21
Reference	22
Appendix A: Listings of Prep Output Files	23
Appendix B: GIANT Files	56
Appendix C: Program Listings	115
Bibliography	117

OPERATING PROCEDURES FOR ANTHROPOMETRY AND INITIAL CONDITIONS PHOTOGRAMMETRIC PROGRAM

Introduction

The Naval Biodynamics Laboratory (NAVBIODYNLAB), located in New Orleans, Louisiana, is a research facility under the cognizance of the Naval Medical Research and Development Command. It is the principal Navy laboratory conducting biomedical research on the effects of mechanical forces encountered in Navy aircrafts and ships. Among its goals are the establishment of human tolerance limits and the development of appropriate methods of avoiding and treating the deleterious effects of such forces. Ongoing research programs at the laboratory acquire sensor and photographic impact acceleration data from acceleration sled runs.

To analyze this data, certain anthropometric information about each subject is necessary. Two anatomical coordinate systems are used, one on the head and one at the base of the neck on the first thoracic vertebra (T-1); these systems are depicted in Figures 1 and 2. The methodology for defining them and for obtaining the appropriate data has been reported previously (Becker, 1977). Motion data collected from inertial instrumentation packages on the head and T-1 are referenced to their own coordinate system; thus knowledge of the transformation matrices from the instrument to the anatomical coordinate systems is also required.

Neck and body information is obtained from two sets of stereoscopic X-rays of the subject with instrument mounts in place. X-rays are taken of T-1, and a set of calibration X-rays is made utilizing a Plexiglass™ target containing an array of radio-opaque BBs located at known positions. A special chair with additional BBs is used to ensure that the subject does not move while a stereoscopic pair of X-rays is made. This "stereopair" consists of two X-rays of the same area taken from different positions so as to afford stereoscopic vision. Two sets of stereopairs (a total of four X-rays) are taken as follows:

- Left eye view — left shoulder to plate
- Right eye view — left shoulder to plate
- Left eye view — right shoulder to plate
- Right eye view — right shoulder to plate

The X-rays are viewed through a mirror stereoscope, a lensed instrument used to view stereopairs. The X-rays are positioned until they form a stereomodel, i.e., a three-dimensional model formed by the intersecting of an overlapping pair of images. Once a stereomodel is formed, the X-rays are secured in place and, using the stereoscope, the points defining the anatomical coordinate system (Figure 1) are marked on the X-ray for digitization.

The method of head anthropometry used previously required two X-rays, which gave a minimally determined solution for the head anatomic coordinate system. To obtain a better solution it was necessary to expose the subject's head to increased radiation. To avoid this additional exposure, optical photogrammetry is used to determine head anthropometry data. Six photographs are taken using the

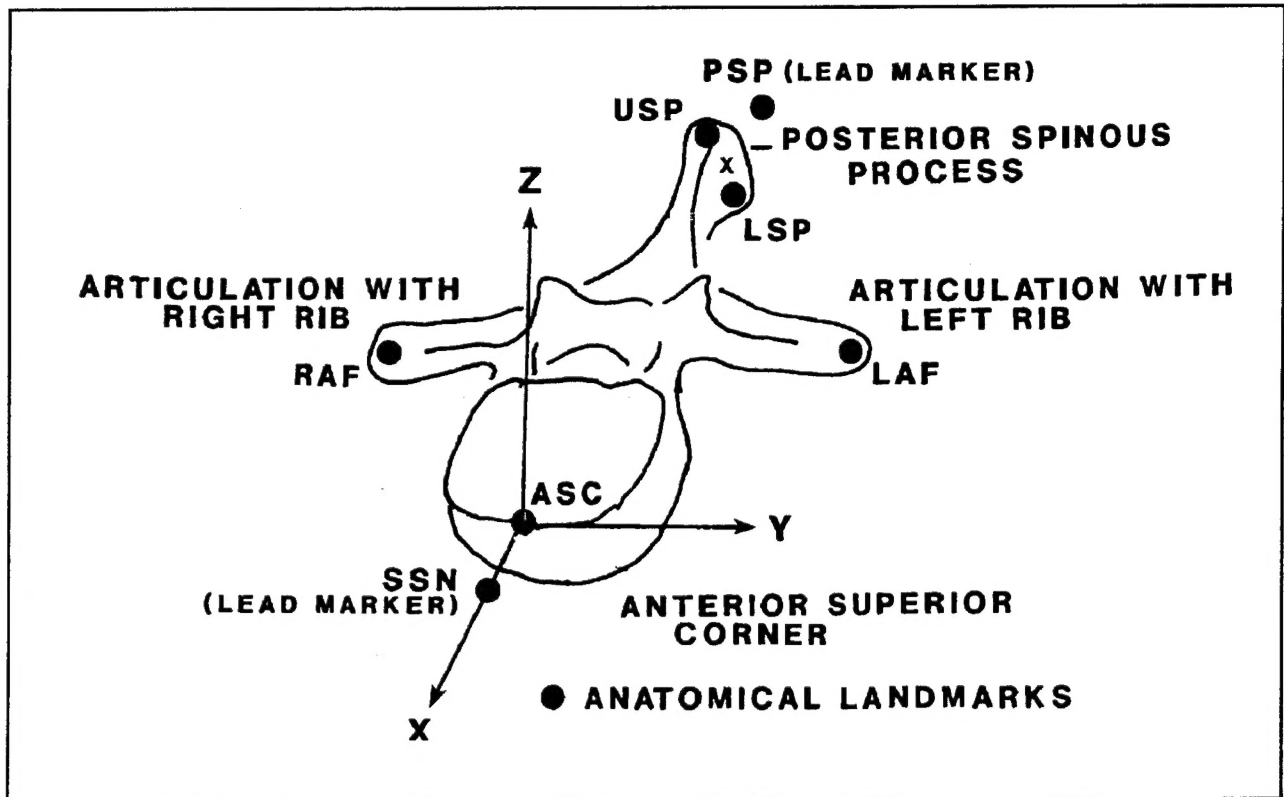


Figure 1. The T₁ Anatomical Coordinate System.

cameras located in the site survey. Photo coordinates are obtained from enlargements using the Altek digitizer.

The optical photogrammetry system used for the initial conditions of accelerator runs is also used for head anthropometry. Control points for a simultaneous block adjustment of the six-camera system have already been determined from the site survey. A test subject is seated on the vertical accelerator chair. The ocular notches are marked with a felt-tip pencil, the mouth mount with BB targets is fitted into place, and ear plugs with the ear targets attached are inserted under a doctor's supervision. All six cameras are fired simultaneously. The film is processed and enlargements made, with prints showing all format edges of each negative. These enlargements are digitized on the Altek digitizer, as described later.

The software package used is NGIANT, a customized version of PC GIANT. PC GIANT is an expanded and enhanced version of the General Integrated Analytical Triangulation program (GIANT), which is a public domain program for mainframe computers. Developed by Elassal et al for Autometric Corporation and later for the U.S. Geological Survey, GIANT will perform a simultaneous bundle adjustment of perspective imagery (photos, X-rays, etc.) by enforcing the collinearity condition. PREP is the pre-processor for transforming comparator coordinates to a plate-centered coordinate system with various corrections for systematic errors. NPREP, a custom version of PREP, was developed by GPA Associates to automate the digitization process and to create the GIANT input image file. NPREP creates the image file for NGIANT for a particular subject by human research volunteer (HRV) number. NGIANT will find all the necessary points in space and compute the locations of the specific body points by regression on the x,y,z coordinates of the targets or known locations. NGIANT then has all the

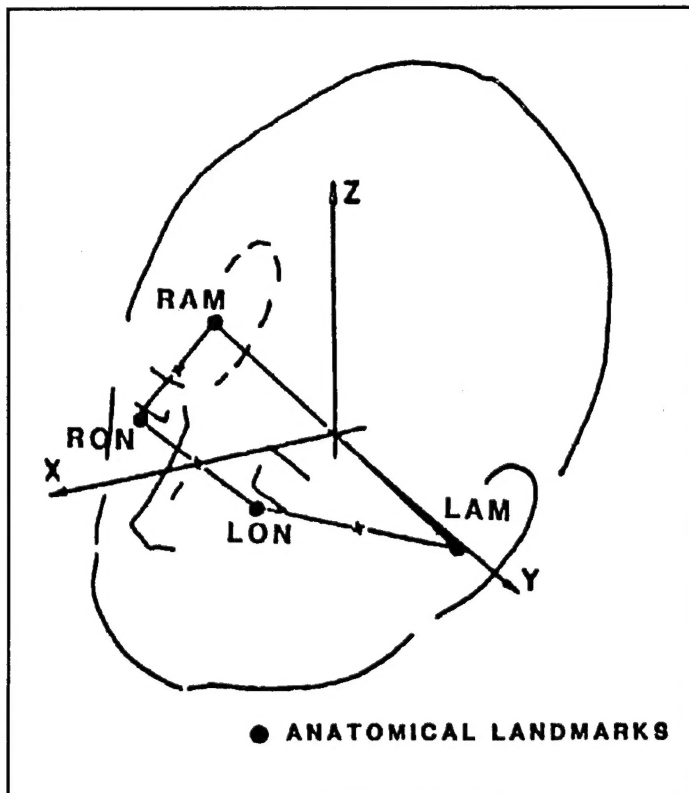


Figure 2. The Head Anatomical Coordinate System.

the firing sequence and are simultaneously exposed a fraction of a second prior to the impact pulse. Enlargements are processed on the Altek digitizer using NPREP. The resulting image file is then read into NGIANT. The output has the locations of the digitized targets on the mouth and T-1 mounts. The particular targets may change with the design of the new sensor package.

Function

The photogrammetric software package consists of two main programs:

- | | | |
|--------|---|---|
| NGIANT | - | Main program which executes GIANT and calculates the transformation from the anatomical to the instrumentation coordinate system. All input must already be in place. |
| NPREP | - | Main Digitization program, which automates the digitization process and creates the NGIANT input image file for a particular subject by HRV number. |

information to calculate the transformation from anatomical to instrumentation coordinate systems.

Initial conditions data may also be acquired. Recent breakthroughs in the miniaturization of rate gyros and accelerometer sensors have made it apparent that direct measurement of "on-board" human impact dynamics can be easily accomplished. With this in mind, exactly where a subject happens to be at various millisecond points in time is immaterial to the analysis of the biodynamics of the impact. The only position-dependant variables in the subsequent analysis are the initial conditions of the subject some infinitesimal instant before impact. This implies that a simultaneous multiple camera exposure is all that is needed for the photogrammetric determination of initial conditions. The new motion detectors require only that initial conditions be determined for the test subject's position and attitude for both head and neck. The same six cameras are aimed to see targets attached to both head and neck and hence target positions can be obtained photogrammetrically. The cameras are tied in to

ALTEK Digitizer

The ALTEK AC30 digitizer is connected on a bi-directional serial port to a 486 personal computer on the COM2 port. ALTEK Corporation's MICRODIJ Universal Digitizer Software is used to interface the personal computer with the digitizer. The use of MICRODIJ is invisible to the user because all the necessary commands have been incorporated into NPREP. The user need only know how to operate the digitizer cursor. The cursor has a viewing site with a set of cross hairs, and its controls have four push buttons and two warning lights.

The center of the cross hairs on the cursor should be positioned on the center of the point to be digitized. The red light will come on when the cursor is out of the digitizing range. The white light comes on when data has been transmitted. The control buttons are defined as follows:

YELLOW	=	MISSING
RED	=	ERROR-BACKUP
GREEN	=	FIDUCIAL OR DATA POINT
BLUE	=	ABORT PHOTO

The green button is used to enter data. If a point is missing (i.e., it cannot be seen on a particular photo or X-ray), the yellow button is pressed. The red button is used when mistakes occur. The blue button is also used for mistakes, but only mistakes regarding photographs. If data for the photo being processed is erroneous, the complete data set may be aborted by pressing the blue button. If the wrong point(s) are input, the red button should be pressed to back up until the correct point is reached. All input is displayed on the screen. Data points will be labelled with X and Y coordinates printed. Missing points and deleted (back up) points will be noted. The user just has to watch the screen. Table 1 summarizes the various digitizing input sequences.

NGIANT

NGIANT is an interactive program for executing a customized version of GIANT. All input files should be in place. The operator may select the following options:

0:	Initial Conditions
1:	Head Anthropometry
2:	Body Anthropometry
3:	Standard GIANT

After an option has been selected, the appropriate subroutine is executed. If option 0 is selected, the run number is requested. If option 3 is selected, a title for the GIANT output is requested. In both cases, GIANT is executed immediately after input, assuming all input files have been created. If option 1 or 2 is selected, an HRV number is requested. After receiving input, the files are searched for an image file labelled *old* with the given HRV number. If the file exists, GIANT is executed. If the file does not exist, an error will be noted and execution terminated. This is also true for options 0 and 3.

Table 1. Summary of the Various Digitizing Sequences	
Initial Conditions	
Fiducials	top 1, top 2, top 3, rt 1, rt 2, rt 3, bot 1, bot 2, bot 3, 1ft 1, 1ft 2, 1ft 3
Targets	mrc1, mrc2, mrc3, mrc4, mrc5, mrc6, mrc7, mrc8, mcc1, mcc2, mcc3, mcc4, mcc5, mcc6, mcc7, mcc8, mlc1, mlc2, mlc3, mlc4, mlc5, mlc6, mlc7, mlc8, nrc1, nrc2, nrc3, nrc4, nrc5, nrc6, nrc7, nrc8, ncc1, ncc2, ncc3, ncc4, ncc5, ncc6, ncc7, ncc8, nlc1, nlc2, nlc3, nlc4, nlc5, nlc6, nlc7, nlc8,
Control	a, b, c, d, f, g, h, j, k, rtc1, rtc2, rtc3, rtc4, rtc5, rtc6, rtc7, rtc8, cen1, cen2, cen3, cen4, cen5, cen6, cen7, cen8, 1fc1, 1fc2, 1fc3, 1fc4, 1fc5, 1fc6, 1fc7, 1fc8
Head Anthropometry	
Fiducials	top 1, top 2, top 3, rt 1, rt 2, rt 3, bot 1, bot 2, bot 3, 1ft 1, 1ft 2, 1ft 3
Targets	ron, lon, ear1-r, ear2-r, ear3-r, ear4-r, ear1-l, ear2-l, ear3-l, ear4-l,
Controls	mrc1, mrc2, mrc3, mrc4, mrc5, mrc6, mrc7, mrc8, mcc1, mcc2, mcc3, mcc4, mcc5, mcc6, mcc7, mcc8, mlc1, mlc2, mlc3, mlc4, mlc5, mlc6, mlc7, mlc8,
Body Anthropometry	
Fiducials	1 2 3 4 5 6 7 8 9 10
Targets	Origin, Rib_1f, Rib_Rt, SpineTop, SpineBot, spine_bb, sternum, 1f_shold, rt_shold, 1neckT, 1neckB, rneckT, rneckB,
Control	r1, r2, r3, r4, r5, r6, r7, r8, c1, c2, c3, c4, c5, c6, c7, c8, 11, 12, 13, 14, 15, 16, 17, 18

NPREP

NPREP is the main digitization and data acquisition program. It interfaces with the ALTEK digitizer to automate the digitization process and creates the NGIANT input image files for a particular subject. The operator may select the following options:

- 0: Initial Conditions
- 1: Head Anthropometry
- 2: Body Anthropometry

To execute NPREP, type NPREP. The COM port number for the Altek digitizer will be requested. Enter the number 2. The screen display will be as follows:

COM2: 9600, 0, 7, 2,-

Enter 0 for initial conditions.

Enter 1 for head anthropometry.

Enter 2 for body anthropometry.

Initial Conditions. If 0 is entered, "enter run number (a6):" will be displayed. The user will enter the run number. "Enter Photo #(1-6, 0 when finished)" will be displayed. The user will enter the number of the photo to be digitized. Finally, the user will be asked to enter specific targets in a predetermined order.

All photos are enlarged with a distinct edge or border so as to depict the area of interest in a well defined block. To establish reference points or calibrated fiducials, three arbitrary measurements are taken in a straight line along the edges of each photo. These are always the first points to be digitized. The sequence is top, right, bottom, and left. The user will be requested to digitize the points as follows:

Enter: top 1 (Digitize 1st point on top edge.)

Enter: top 2

Enter: top 3

Enter: rt 1 (Digitize 1st point on right edge.)

Enter: rt 2

Enter: rt 3

Enter: bot 1 (Digitize 1st point on bottom edge.)

Enter: bot 2

Enter: bot 3

Enter: lft 1

Enter: lft 2

Enter: lft 3 (Digitize last point on left edge.)

The data is analyzed and error values are displayed. The user should check the rms values. These should always be very small, definitely less than 1.0. The user will be given the option to continue. If

Anthropometry and Initial Conditions Photogrammetric Program

the rms values are too large, the user should exit the program and start over.

Once the reference points are entered correctly, the user will be requested to digitized the targets as follows:

```
Enter: a      (Digitize target A.)
Enter: b
Enter: c
Enter: d
Enter: f
Enter: g
Enter: h
Enter: j
Enter: k
Enter: rtc1   (Digitize corner 1 of right cube.)
Enter: rtc2
Enter: rtc3
Enter: rtc4
Enter: rtc5
Enter: rtc6
Enter: rtc7
Enter: rtc8
Enter: cen1   (Digitize corner 1 of center cube.)
Enter: cen2
Enter: cen3
Enter: cen4
Enter: cen5
Enter: cen6
Enter: cen7
Enter: cen8
Enter: lfc1   (Digitize corner 1 of left cube.)
Enter: lfc2
Enter: lfc3
Enter: lfc4
Enter: lfc5
Enter: lfc6
Enter: lfc7
Enter: lfc8
```

"Press Enter to Continue" is displayed. Press Enter.

Runs before LZ0930 are processed as follows:

```
Enter: m-r1   (Digitize corner 1 of cube on right side of mouth mount.)
Enter: m-r4   (Digitize corner 4 of cube on right side of mouth mount.)
Enter: m-t1   (Digitize corner 1 of cube on top part of mouth mount.)
Enter: m-t4   (Digitize corner 4 of cube on top part of mouth mount.)
```


NAVAL BIODYNAMICS LABORATORY SOFTWARE DOCUMENTATION

Enter: m-b1 (Digitize corner 1 of cube on bottom part of mouth mount.)
Enter: m-b4 (Digitize corner 4 of cube on bottom part of mouth mount.)
Enter: m-11 (Digitize corner 1 of cube on left side of mouth mount.)
Enter: m-14 (Digitize corner 4 of cube on left side of mouth mount.)
Enter: t-r1 (Digitize corner 1 of cube on right side T-plate.)
Enter: t-r4 (Digitize corner 4 of cube on right side of T-plate.)
Enter: t-c1 (Digitize corner 1 of cube on center of T-plate.)
Enter: t-c4 (Digitize corner 4 of cube on center of T-plate.)
Enter: t-11 (Digitize corner 1 of cube on left side of T-plate.)
Enter: t-14 (Digitize corner 4 of cube on left side on T-plate.)

Runs LZ0930 through the present are processed as follows:

Enter: mrc1 (Digitize corner 1 of right cube on the mouth mount.)
Enter: mrc2 (Digitize corner 2 of right cube on the mouth mount.)
Enter: mrc3 (Digitize corner 3 of right cube on the mouth mount.)
Enter: mrc4 (Digitize corner 4 of right cube on the mouth mount.)
Enter: mrc5 (Digitize corner 5 of right cube on the mouth mount.)
Enter: mrc6 (Digitize corner 6 of right cube on the mouth mount.)
Enter: mrc7 (Digitize corner 7 of right cube on the mouth mount.)
Enter: mrc8 (Digitize corner 8 of right cube on the mouth mount.)

Enter: mcc1 (Digitize corner 1 of the center cube on the mouth mount.)
Enter: mcc2 (Digitize corner 2 of the center cube on the mouth mount.)
Enter: mcc3 (Digitize corner 3 of the center cube on the mouth mount.)
Enter: mcc4 (Digitize corner 4 of the center cube on the mouth mount.)
Enter: mcc5 (Digitize corner 5 of the center cube on the mouth mount.)
Enter: mcc6 (Digitize corner 6 of the center cube on the mouth mount.)
Enter: mcc7 (Digitize corner 7 of the center cube on the mouth mount.)
Enter: mcc8 (Digitize corner 8 of the center cube on the mouth mount.)

Enter: mlc1 (Digitize corner 1 of the left cube on the mouth mount.)
Enter: mlc2 (Digitize corner 2 of the left cube on the mouth mount.)
Enter: mlc3 (Digitize corner 3 of the left cube on the mouth mount.)
Enter: mlc4 (Digitize corner 4 of the left cube on the mouth mount.)
Enter: mlc5 (Digitize corner 5 of the left cube on the mouth mount.)
Enter: mlc6 (Digitize corner 6 of the left cube on the mouth mount.)
Enter: mlc7 (Digitize corner 7 of the left cube on the mouth mount.)
Enter: mlc8 (Digitize corner 8 of the left cube on the mouth mount.)

Enter: nrc1 (Digitize corner 1 of the right cube on the neck mount.)
Enter: nrc2 (Digitize corner 2 of the right cube on the neck mount.)
Enter: nrc3 (Digitize corner 3 of the right cube on the neck mount.)
Enter: nrc4 (Digitize corner 4 of the right cube on the neck mount.)
Enter: nrc5 (Digitize corner 5 of the right cube on the neck mount.)
Enter: nrc6 (Digitize corner 6 of the right cube on the neck mount.)

Anthropometry and Initial Conditions Photogrammetric Program

Enter: nrc7 (Digitize corner 7 of the right cube on the neck mount.)
Enter: nrc8 (Digitize corner 8 of the right cube on the neck mount.)

Enter: ncc1 (Digitize corner 1 of the center cube on the neck mount.)
Enter: ncc2 (Digitize corner 2 of the center cube on the neck mount.)
Enter: ncc3 (Digitize corner 3 of the center cube on the neck mount.)
Enter: ncc4 (Digitize corner 4 of the center cube on the neck mount.)
Enter: ncc5 (Digitize corner 5 of the center cube on the neck mount.)
Enter: ncc6 (Digitize corner 6 of the center cube on the neck mount.)
Enter: ncc7 (Digitize corner 7 of the center cube on the neck mount.)
Enter: ncc8 (Digitize corner 8 of the center cube on the neck mount.)

Enter: nlc1 (Digitize corner 1 of the left cube on the neck mount.)
Enter: nlc2 (Digitize corner 2 of the left cube on the neck mount.)
Enter: nlc3 (Digitize corner 3 of the left cube on the neck mount.)
Enter: nlc4 (Digitize corner 4 of the left cube on the neck mount.)
Enter: nlc5 (Digitize corner 5 of the left cube on the neck mount.)
Enter: nlc6 (Digitize corner 6 of the left cube on the neck mount.)
Enter: nlc7 (Digitize corner 7 of the left cube on the neck mount.)
Enter: nlc8 (Digitize corner 8 of the left cube on the neck mount.)

"Enter Photo # (1-6, 0 when finished)" will be displayed at the end of processing. Repeat the above steps for each photo to be digitized. Enter 0 at this prompt when you have digitized the last photo.

Head Anthropometry. After entering the number 1 as the processing option, the display will be: "Enter HRV number." The user will enter a four digit integer as the human research volunteer number (i.e., 0222 for HRV number H-222). The following will be printed: "Default ear offsets are: 5.420", 5.420", OK?" Press the RETURN key to accept these defaults, any other key to change them. If the user presses RETURN, processing will continue. "Enter left and right ear offsets:" will be displayed if anything else is entered. The user will be given this information before processing.

The files are then searched to insure that new data is being processed. If data for the given subject exists, the program will terminate and the user will be notified that the data already exists. If the data does not exist, the user will be requested to digitize the points as follows:

The edges, targets A-K, the right cube corners, the center cube corners, and the left cube corners are digitized in the same sequence as for initial conditions. (See Initial Conditions section, page 6). The head anthropometry data is requested after all reference points have been digitized. The input for runs before LZ0930 is as follows:

Enter: rtp (Digitize right side of T-plate.)
Enter: ctp (Digitize center of T-plate.)
Enter: ltp (Digitize left side of T-plate.)
Enter: ron (Digitize right orbital notch (eye).)
Enter: lon (Digitize left orbital notch (eye).)
Enter: ear1-r (Digitize right ear target farthest away from head.)
Enter: ear2-r (Digitize 2nd farthest right ear target.)

NAVAL BIODYNAMICS LABORATORY SOFTWARE DOCUMENTATION

Enter: ear3-r (Digitize 2nd closest right ear target.)
Enter: ear4-r (Digitize right ear target closest to head.)
Enter: ear1-l (Digitize left ear target farthest away from head.)
Enter: ear2-l (Digitize 2nd farthest left ear target.)
Enter: ear3-l (Digitize 2nd closest left ear target.)
Enter: ear4-l (Digitize left ear target closest to head.)

Runs from LZ0930 and above are processed as follows:

Enter: ron (Digitize right orbital notch eye.)
Enter: lon (Digitize left orbital notch eye.)
Enter: ear1-r (Digitize right ear target farthest away from head.)
Enter: ear2-r (Digitize 2nd farthest right ear target.)
Enter: ear3-r (Digitize 2nd closest right ear target.)
Enter: ear4-r (Digitize right ear target closest to head.)
Enter: ear1-l (Digitize left ear target farthest away from head.)
Enter: ear2-l (Digitize 2nd farthest left ear target.)
Enter: ear3-l (Digitize 2nd closest left ear target.)
Enter: ear4-l (Digitize left ear target closest to head.)
Enter: mrc1 (Digitize corner 1 of the right cube on the mouth mount.)
Enter: mrc2 (Digitize corner 2 of the right cube on the mouth mount.)
Enter: mrc3 (Digitize corner 3 of the right cube on the mouth mount.)
Enter: mrc4 (Digitize corner 4 of the right cube on the mouth mount.)
Enter: mrc5 (Digitize corner 5 of the right cube on the mouth mount.)
Enter: mrc6 (Digitize corner 6 of the right cube on the mouth mount.)
Enter: mrc7 (Digitize corner 7 of the right cube on the mouth mount.)
Enter: mrc8 (Digitize corner 8 of the right cube on the mouth mount.)
Enter: mcc1 (Digitize corner 1 of the center cube on the mouth mount.)
Enter: mcc2 (Digitize corner 2 of the center cube on the mouth mount.)
Enter: mcc3 (Digitize corner 3 of the center cube on the mouth mount.)
Enter: mcc4 (Digitize corner 4 of the center cube on the mouth mount.)
Enter: mcc5 (Digitize corner 5 of the center cube on the mouth mount.)
Enter: mcc6 (Digitize corner 6 of the center cube on the mouth mount.)
Enter: mcc7 (Digitize corner 7 of the center cube on the mouth mount.)
Enter: mcc8 (Digitize corner 8 of the center cube on the mouth mount.)

Enter: mlc1 (Digitize corner 1 of the left cube on the mouth mount.)
Enter: mlc2 (Digitize corner 2 of the left cube on the mouth mount.)
Enter: mlc3 (Digitize corner 3 of the left cube on the mouth mount.)
Enter: mlc4 (Digitize corner 4 of the left cube on the mouth mount.)
Enter: mlc5 (Digitize corner 5 of the left cube on the mouth mount.)
Enter: mlc6 (Digitize corner 6 of the left cube on the mouth mount.)
Enter: mlc7 (Digitize corner 7 of the left cube on the mouth mount.)
Enter: mlc8 (Digitize corner 8 of the left cube on the mouth mount.)

"Enter photo #(1-6, 0 when finished)" will be displayed at the end of processing. Repeat the above

steps for each photo to be digitized. Enter 0 to this prompt when you have digitized the last photo.

Body (Neck) Anthropometry. As discussed earlier, the neck anthropometry is obtained from X-rays. This will be referred to as *body anthropometry* because in this new procedure more than the neck is considered. After the number 2 is entered as the processing option, the display will be: "Enter HRV number." The user will enter a four digit integer as the HRV number (i.e., 0222 would be entered for HRV number H-222). If a data file exists for the given subject, the program will terminate with a file error. No specific details will be relayed to the user. If the data does not exist, processing will continue and the following will be displayed: "Enter number of parameters for shrinkage fit:" The user will input the number 8, and the following will appear:

Enter 0 when finished

Enter 1 if: Left eye view-left shoulder to plate

Enter 2 if: Right eye view-left shoulder to plate

Enter 3 if: Left eye view-right shoulder to plate

Enter 4 if: Right eye view-right shoulder to plate

The number to be entered is determined by the X-ray being digitized. The numbers 1 through 4 represent the four X-rays discussed earlier. The T-1 anatomical coordinate system (Figure 1) should have been marked on these X-rays in stereo before digitization. The user will be requested to digitize the points as outlined in Figure 3 or Figure 4.

Fiducials 1 through 10 are entered first. The user must follow the sequence indicated in Figures 3 and 4. There is no prompting. However, the data entered is printed on the screen to ensure proper entry. The user must check the screen to verify correct digitization.

The input will be as follows:

Fiducial 1 (Input carefully; you will have to re-enter it to close out.)

·
·
·

Fiducial 10

As with the others, an error value will be printed. Check the rms value; it must be less than one. If not, the data is erroneous and you must start over.

Runs before LZ0930 are processed as follows:

Origin	
Rib-lf	(Left Rib Articulation)
Rib-rt	(Right Rib Articulation)
Spine Top	(Top Spinous Process)
Spine Bot	(Bottom Spinous Process)
Spine-bb	(Posterior Spinous Process)
Sternum	
lf-shold	(Left Shoulder)
rt-shold	(Right Shoulder)

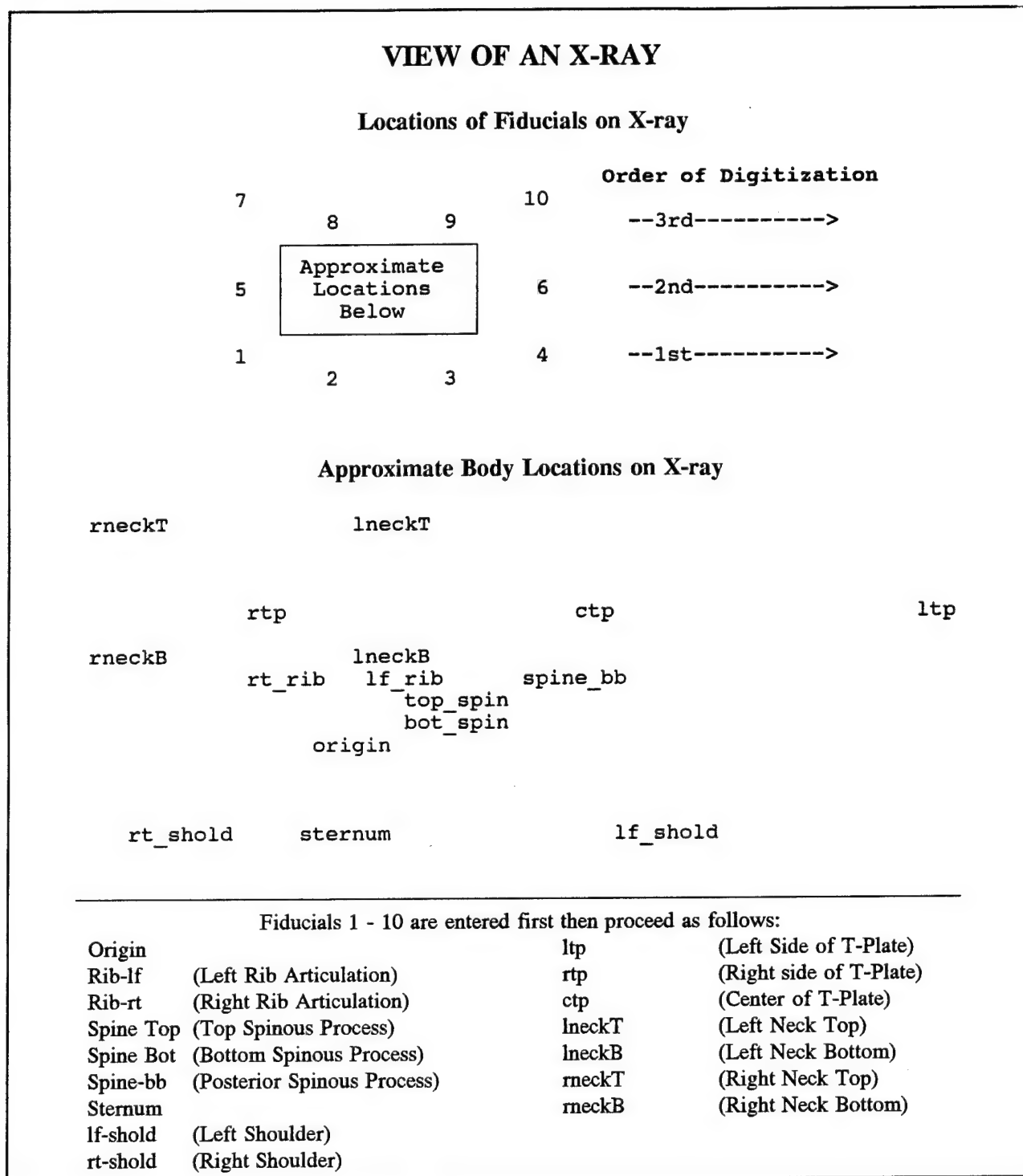


Figure 3. X-ray anthropometry digitization schematic diagram: Pre-mount modification — T-plate.

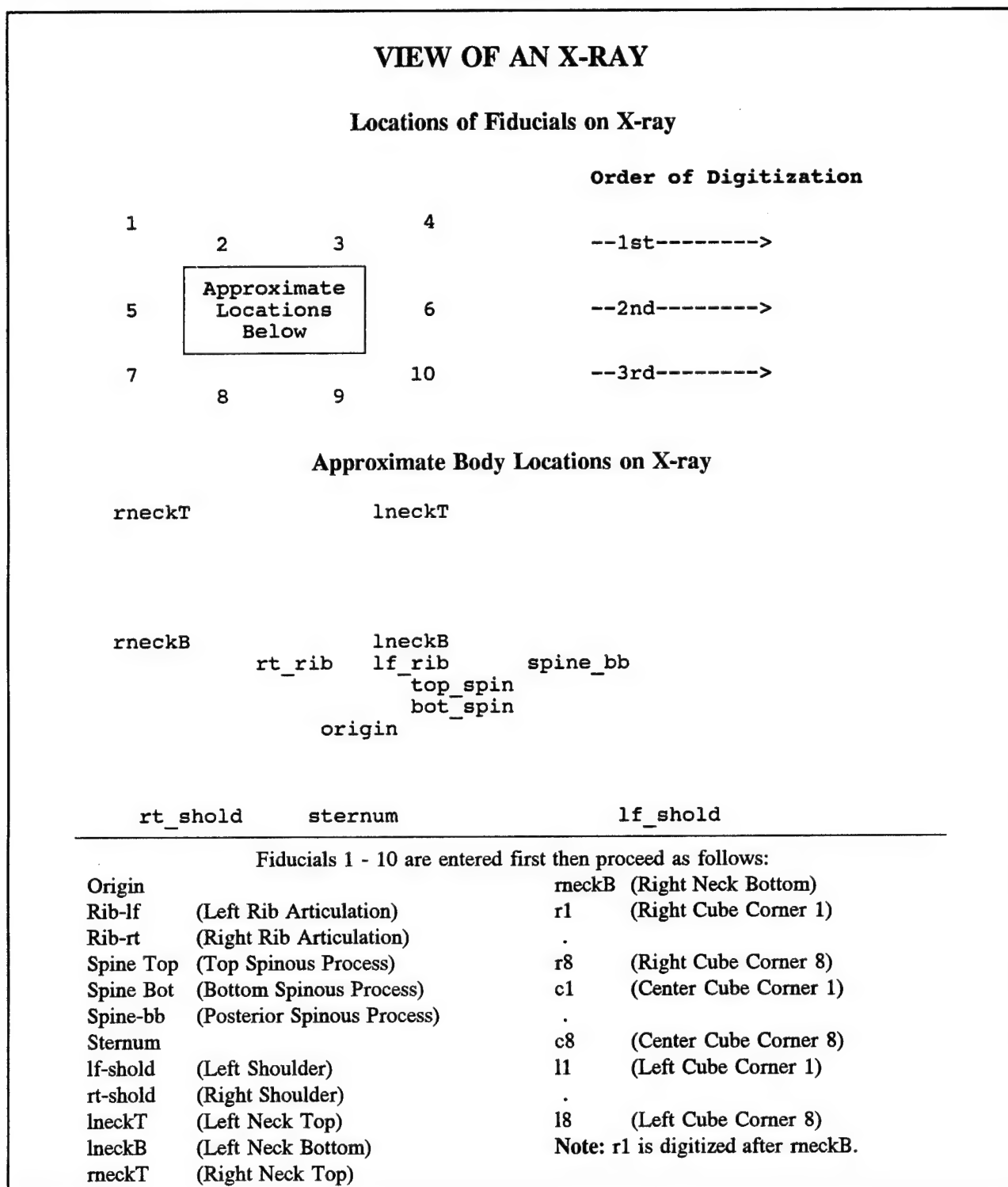


Figure 4. X-ray Anthropometry Digitizing Schematic Diagram: Post Mount Modification — No T-plate.

NAVAL BIODYNAMICS LABORATORY SOFTWARE DOCUMENTATION

ltp	(Left Side of T-Plate)
rtp	(Right side of T-Plate)
ctp	(Center of T-Plate)
lneckT	(Left Neck Top)
lneckB	(Left Neck Bottom)
rneckT	(Right Neck Top)
rneckB	(Right Neck Bottom)

Re-do first fiducial (Re-digitize the first point you digitized)

Runs from LZ0930 and above are processed as follows:

Origin	
Rib-lf	(Left Rib Articulation)
Rib-rt	(Right Rib Articulation)
Spine Top	(Top Spinous Process)
Spine Bot	(Bottom Spinous Process)
Spine-bb	(Posterior Spinous Process)
Sternum	
lf-shold	(Left Shoulder)
rt-shold	(Right Shoulder)
lneckT	(Left Neck Top)
lneckB	(Left Neck Bottom)
rneckT	(Right Neck Top)
rneckB	(Right Neck Bottom)

r1	(Right Cube Corner 1)
r2	(Right Cube Corner 2)
r3	(Right Cube Corner 3)
r4	(Right Cube Corner 4)
r5	(Right Cube Corner 5)
r6	(Right Cube Corner 6)
r7	(Right Cube Corner 7)
r8	(Right Cube Corner 8)

c1	(Center Cube Corner 1)
c2	(Center Cube Corner 2)
c3	(Center Cube Corner 3)
c4	(Center Cube Corner 4)
c5	(Center Cube Corner 5)
c6	(Center Cube Corner 6)
c7	(Center Cube Corner 7)
c8	(Center Cube Corner 8)

11	(Left Cube Corner 1)
12	(Left Cube Corner 2)

Anthropometry and Initial Conditions Photogrammetric Program

- 13 (Left Cube Corner 3)
- 14 (Left Cube Corner 4)
- 15 (Left Cube Corner 5)
- 16 (Left Cube Corner 6)
- 17 (Left Cube Corner 7)
- 18 (Left Cube Corner 8)

Re-do first fiducial (Re-digitize the first point you digitized)

Repeat the above steps for each X-ray.

Note that the user should be especially careful when digitizing fiducial 1. This is the close-out reference point. The first and last the data points entered are compared to check the accuracy of the data. If the difference between the two is too great, the user will be given four tries to read the point correctly. After four tries, the program will terminate and all the data will have to be re-entered.

Additional Information. Mounts similar to those shown in Figures 5 and 6 have been used on the mouth and neck to gain initial conditions, head anthropometry, and body anthropometry data. All references to right and left, for both photos and X-rays, are with respect to the subject. The right cube is on the subject's right and the left cube on the subject's left. The cubes are numbered as shown in Figure 7. The mount is in a different position when on the neck. Figure 8 shows the position of the mount when on the neck (lying down). Note that the numbering of the corners of the cubes have not changed. Only the positions of the cubes have changed.

Programs

The following program and subroutines are available:

- DIGITIZE — Main digitization program which digitizes data and creates the GIANT image data files (NPREP).
- HEAD — Digitizes head anthropometry and initial conditions.
- BODY — Digitizes body anthropometry.
- FID — Determines corner fiducials.
- FOURP — Calculates the three- or four-parameter transformations.
- FIVEP — Calculates the five-parameter transformation.
- SIXP — Calculates the six-parameter transformation.
- EIGHTP — Calculates the eight-parameter transformation.

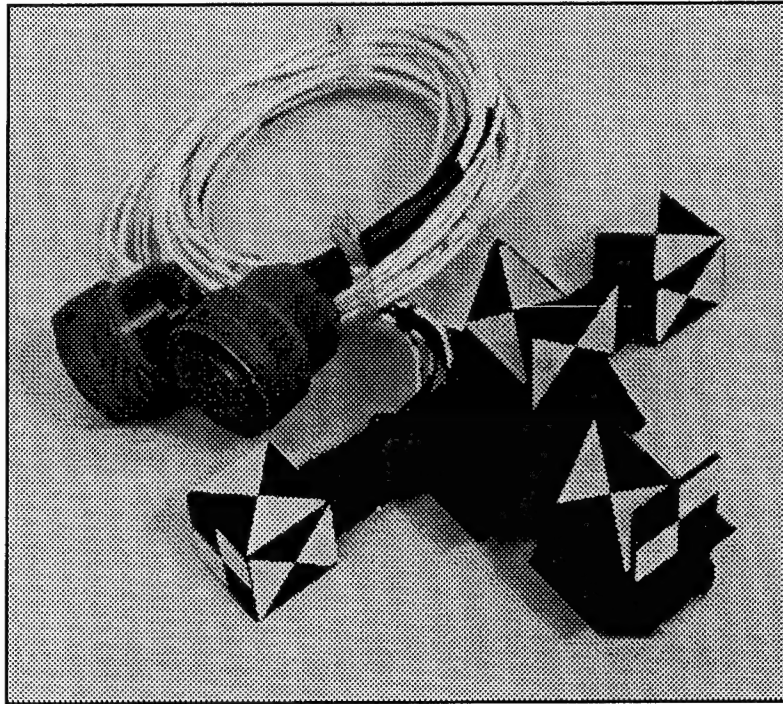


Figure 5. T-Plate Mount.

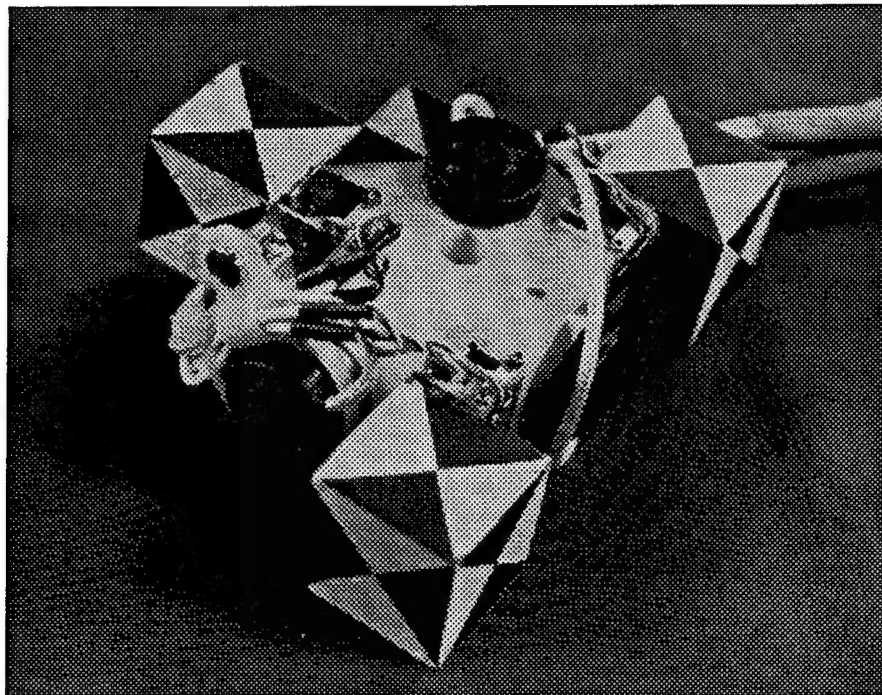


Figure 6. Photogrammetric Mount.

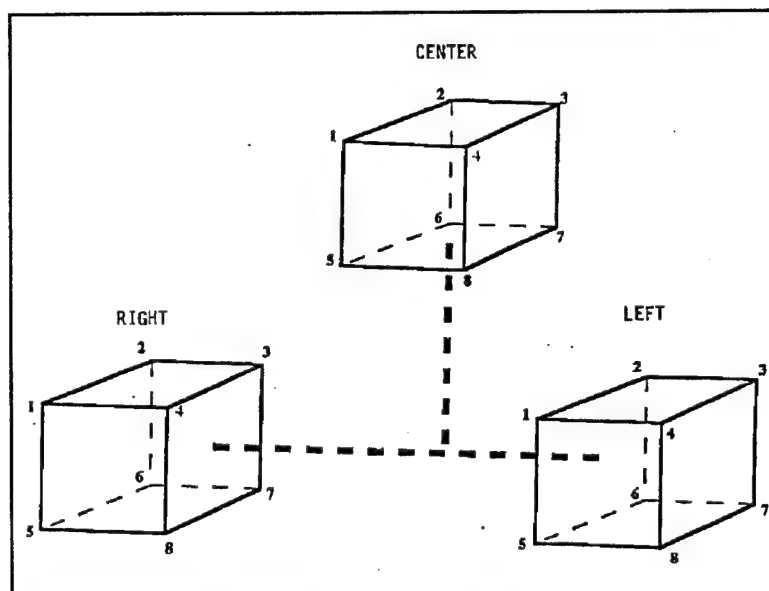


Figure 7. Corner Designations for Photogrammetry: Position on Mouth.

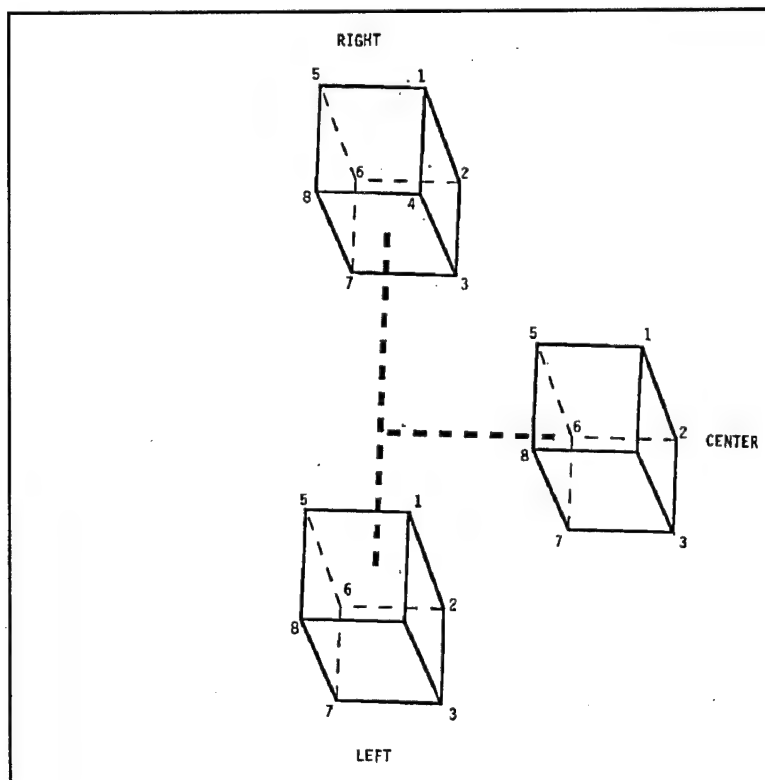


Figure 8. Corner Designations for Photogrammetry: Position of Neck.

NAVAL BIODYNAMICS LABORATORY SOFTWARE DOCUMENTATION

ACCAPR	— Acquires approximate values of the eight-parameter transformation.
ACCNEQ	— Acquires normal equations for the eight-parameter transformation.
INVERT	— Finds the inverse of a matrix.
LINSOL	— Solves linear equations.
CLEAR	— Clears the screen and moves the cursor to row 8.
NEWPAG	— Writes title and page number.

Subroutine Descriptions

HEADS. The HEADS routine allows the operator to digitize head anthropometry or initial conditions photos. The call is:

CALL HEADS(IANS)

where

IANS = 0 for digitization of initial conditions
 = 1 for digitization of head anthropometry

BODY. The BODY routine allows the operator to digitize body anthropometry X-rays. The call is:

CALL BODY

FID. The FID routine intersects the edge lines formed by a least squares solution on three points to give the corner fiducials. It also stores the output in the same array used for input. The call is:

CALL FID(Z)

where

Z = X, Y coordinates of three points along the four edges of the photo when Z is the input.
 = The corner fiducials coordinates when Z is the output.

Anthropometry and Initial Conditions Photogrammetric Program

FOURP. The FOURP routine calculates the three- and four-parameter transformation between an exact set of data and a corresponding set of measured data. The call is:

CALL FOURP

FIVEP. The FIVEP routine calculates the five-parameter transformation between an exact set of data and a corresponding set of measured data. The call is:

CALL FIVEP

SIXP. The SIXP routine calculates the six-parameter transformation between an exact set of data and a corresponding set of measured data. The call is:

CALL SIXP

EIGHTP. The EIGHTP routine calculates the eight-parameter transformation between an exact set of data and a corresponding set of measured data. The call is:

CALL EIGHTP

ACCAPR. The ACCAPR routine evaluates the contribution of one point to the 8×9 matrix of normal equations for computation of approximate values of the eight-parameter film shrinkage transformation. The call is:

CALL ACCAPR(XG,YG,XP,YP)

where

XG = Calibrated X fiducial coordinate
YG = Calibrated Y fiducial coordinate
XP = Observed X fiducial coordinate
YP = Observed Y fiducial coordinate

EQN = 8×8 coefficient matrix of the Normal Equation with the vector of constants in column 9

ACCNEQ. The ACCNEQ routine evaluates the contribution of one point to the normal equation required for subroutine EIGHTP. The normal equations are required to compute corrections to the last estimate of the eight-transformation parameters. This routine is called once for each point. The call is:

CALL ACCNEQ(XG,YG,XP,YP)

where

XG = Calibrated X fiducial coordinate
YG = Calibrated Y fiducial coordinate
XP = Observed X fiducial coordinate
YP = Observed Y fiducial coordinate
EQN = 8×8 coefficient matrix of the Normal Equation with the vector of constants in column 9

INVERT. The INVERT routine finds the inverse of a matrix by the Gaussian Elimination Method. The routine will search for the largest non-singular matrix in the input array, invert it, and return the inverse in the same array. The call is:

CALL INVERT(A,N,D)

where

A = Array in which the matrix to be inverted is located and also the location of the inverted matrix that is returned.
N = The first dimension of array A when used in the call statement. It contains the rank of the largest matrix contained in A as a returned value.
D = The determinant of the largest non-singular matrix in A.

LINSOL. The LINSOL routine solves a specified number of linear equations with a specified number of unknowns. The call is:

CALL LINSOL(NPAR)

where

NPAR = The number of linear equations and the number of unknowns

CLEAR. The CLEAR routine clears the screen and moves the cursor to row eight. The call is:

CALL CLEAR

NEWPAG. The NEWPAG routine prints the title, page number, and any header information on each page. The call is:

CALL NEWPAG

Giant Subroutines Customized for NAVBIODYNLAB

Several subroutines were added to GIANT to enhance the program for use by NAVBIODYNLAB. These include the following subroutines:

- ANTHRO — Verifies that the needed 13 head or 8 body points are available. This routine finds the transformations and prints the results.
- EXTRAPOLATE — Extrapolates anthropometry data.
- GETICV — Searches object point IDs for matching IDs of targets on the head, mouth, and neck. Desired variables are saved for the initial conditions data file.
- ICONS — Writes initial conditions data to a file.
- NBDL — Finds the origin and transformation matrices of the mount relative to the head/body anatomical origin in the anatomical coordinate system.
- STUFFP — Searches object point IDs to find matching IDs in the anthropometry list and stores object point data in corresponding locations in an array.
- UVEC — This routine creates a unit vector.

Reference

Becker, E. B., "Stereoradiographic Measurements for Anatomically Mounted Instruments," *Proceedings of the Twenty-First STAPP Car Crash Conference*, Society of Automotive Engineers, Inc., Warrendale, PA, pp. 477-505, October, 1977.

Appendixes

Appendix A Listings of Prep Output Files

Body Anthropometry Printed Output

Naval BioDynamics Laboratory PREP
Body Anthropometry for HRV # 00253

Page 1
Date: 10/08/92

Calibrated Fiducial Coordinates of Frame LfEyLfSh

Fid	X	Y
1	-193.950	148.160
2	-80.380	162.380
3	75.670	164.310
4	191.214	148.961
5	-193.920	-5.010
6	192.310	-4.800
7	-193.010	-159.210
8	-80.050	-147.600
9	75.390	-144.880
10	192.720	-158.520

Naval BioDynamics Laboratory PREP
Body Anthropometry for HRV # 00253

Page 2
Date: 10/08/92

Fiducial Measurements of Frame LfEyLfSh

ID	Measured	
	X	Y
1	79.426	328.828
2	193.294	343.332
3	348.945	345.897
5	80.645	175.463
6	466.141	177.749
8	195.428	33.884
9	350.190	37.135

8-Parameter Residuals of the Fiducial Coordinates

Fid	X	Y
1	-0.138	0.080
2	0.169	-0.090
3	-0.068	-0.045
5	0.013	-0.034
6	0.058	0.168

NAVAL BIODYNAMICS LABORATORY SOFTWARE DOCUMENTATION

8	0.094	0.138
9	-0.127	-0.216
Rms	0.108	0.126
Rms(check)	0.300	0.206

Transformation Parameters Are:

1.001305	0.005593	-275.7444	-0.000006	0.000006
-0.004836	1.000885	-180.2756		

Naval BioDynamics Laboratory PREP
Body Anthropometry for HRV # 00253

Page 3
Date:10/08/92

Plate Coordinates for Frame LfEyLfSh

ID	Measured		Adjusted	
	X	Y	X	Y
Origin	392.684	196.063	118.707	14.080
Rib_Lf	392.405	185.572	118.376	3.568
Rib_Rt	343.433	206.654	69.359	24.925
SpineTop	306.248	199.390	32.043	17.823
SpineBot	302.311	189.509	28.043	7.946
spine_bb	276.987	197.028	2.708	15.596
sternum	404.876	100.863	130.484	-81.443
lf_shold	304.571	91.186	29.776	-90.609
lneckT	284.099	232.283	10.029	50.860
lneckB	282.245	164.922	7.797	-16.586
rneckT	94.056	242.087	-180.056	61.518
rneckB	93.091	160.071	-181.569	-20.506
r1	208.661	284.251	-65.197	103.179
r2	209.423	258.293	-64.590	77.216
r3	217.449	261.341	-56.539	80.230
r4	218.694	296.418	-55.086	115.302
r5	229.387	281.711	-44.472	100.553
r6	230.226	256.184	-43.783	75.017
r7	241.859	260.071	-32.115	78.854
r8	242.087	294.361	-31.688	113.149
c1	193.192	281.940	-80.686	100.933
c2	192.557	255.448	-81.482	74.444
c3	198.933	261.163	-75.069	80.132
c4	200.990	294.589	-72.809	113.547
c5	212.801	280.238	-61.078	99.149
c6	212.928	254.991	-61.102	73.898
c7	223.520	259.740	-50.473	78.603
c8	223.291	290.805	-50.519	109.671
l1	279.654	285.420	5.871	104.052
l2	279.070	257.099	5.129	75.719
l3	298.475	258.953	24.577	77.490
l4	299.796	287.757	26.057	106.306
l5	298.298	283.464	24.533	102.017
l6	297.967	256.210	24.053	74.747
l7	318.389	256.896	44.519	75.345
l8	317.170	285.725	43.451	104.200

Anthropometry and Initial Conditions Photogrammetric Program

Naval BioDynamics Laboratory PREP
Body Anthropometry for HRV # 00253

Page 4
Date: 10/08/92

Calibrated Fiducial Coordinates of Frame RtEyLfSh

Fid	X	Y
1	-193.950	148.160
2	-80.380	162.380
3	75.670	164.310
4	191.214	148.961
5	-193.920	-5.010
6	192.310	-4.800
7	-193.010	-159.210
8	-80.050	-147.600
9	75.390	-144.880
10	192.720	-158.520

Naval BioDynamics Laboratory PREP
Body Anthropometry for HRV # 00253

Page 5
Date: 10/08/92

Fiducial Measurements of Frame RtEyLfSh

ID	Measured X	Y
1	112.192	337.490
2	226.136	351.282
3	382.219	352.704
4	498.500	336.982
5	111.684	184.302
6	498.780	183.007
8	225.273	41.123
9	380.670	42.901

8-Parameter Residuals of the Fiducial Coordinates

Fid	X	Y
1	-0.082	0.030
2	0.160	-0.046
3	-0.189	-0.065
4	0.140	-0.026
5	-0.053	0.057
6	0.000	0.180
8	0.179	0.011
9	-0.155	-0.141

Rms	0.135	0.089
Rms (check)	0.374	0.200

Transformation Parameters Are:

1.000134	-0.004064	-305.1258	0.000006	0.000002
0.004181	1.001018	-189.9147		

NAVAL BIODYNAMICS LABORATORY SOFTWARE DOCUMENTATION

Naval BioDynamics Laboratory PREP
Body Anthropometry for HRV # 00253

Page 6
Date: 10/08/92

Plate Coordinates for Frame RtEyLfSh

ID	Measured		Adjusted	
	X	Y	X	Y
Origin	341.097	196.774	35.129	8.464
Rib_Lf	342.113	187.020	36.183	-1.271
Rib_Rt	293.040	209.525	-12.869	21.002
SpineTop	267.945	208.229	-37.913	19.606
SpineBot	263.195	198.425	-42.616	9.793
spine_bb	237.922	205.613	-67.880	16.871
sternum	351.790	107.417	46.164	-80.724
lf_shold	277.038	98.222	-28.395	-90.261
lneckT	257.962	240.386	-48.006	51.687
lneckB	254.991	172.872	-50.706	-15.770
r1	175.108	293.167	-130.970	104.111
r2	175.616	267.106	-130.363	78.073
r3	175.920	271.221	-130.075	82.186
r4	177.902	306.375	-128.229	117.318
r5	197.510	290.474	-108.576	101.500
r6	198.069	265.354	-107.921	76.405
r7	201.498	269.418	-104.511	80.478
r8	202.743	303.886	-103.401	114.917
c1	161.087	291.236	-144.976	102.133
c2	160.350	264.465	-145.610	75.377
c3	159.360	271.018	-146.625	81.922
c4	161.366	304.216	-144.745	115.104
c5	181.940	289.001	-124.127	99.973
c6	181.940	263.855	-124.031	74.847
c7	185.268	269.138	-120.726	80.139
c8	185.293	300.152	-120.820	111.126
l1	245.567	293.878	-60.593	105.070
l2	244.500	265.557	-61.547	76.779
l3	262.661	267.106	-43.421	78.394
l4	264.160	295.885	-42.040	107.139
l5	265.633	291.440	-40.552	102.705
l6	264.719	264.109	-41.356	75.408
l7	283.591	264.744	-22.521	76.112
l8	282.956	293.370	-23.270	104.694

Naval BioDynamics Laboratory PREP
Body Anthropometry for HRV # 00253

Page 7
Date: 10/08/92

Calibrated Fiducial Coordinates of Frame LfEyRtSh

Fid	X	Y
1	-193.950	148.160
2	-80.380	162.380
3	75.670	164.310
4	191.214	148.961
5	-193.920	-5.010
6	192.310	-4.800
7	-193.010	-159.210
8	-80.050	-147.600

Anthropometry and Initial Conditions Photogrammetric Program

9	75.390	-144.880
10	192.720	-158.520

Naval BioDynamics Laboratory PREP
Body Anthropometry for HRV # 00253

Page 8
Date: 10/08/92

Fiducial Measurements of Frame LfEyRtSh

ID	Measured	
	X	Y
2	215.011	356.464
3	370.840	356.108
4	486.004	339.065
5	99.162	190.627
6	484.683	185.598
8	210.871	46.711
9	366.039	47.523

8-Parameter Residuals of the Fiducial Coordinates

Fid	X	Y
2	0.015	0.041
3	-0.079	0.004
4	0.045	-0.040
5	0.039	-0.015
6	0.008	-0.003
8	-0.043	-0.048
9	0.015	0.060
Rms	0.041	0.037
Rms(check)	0.225	0.203

Transformation Parameters Are:

1.001048	-0.014627	-290.4377	-0.000005	0.000005
0.013654	1.000787	-197.1577		

Naval BioDynamics Laboratory PREP
Body Anthropometry for HRV # 00253

Page 9
Date: 10/08/92

Plate Coordinates for Frame LfEyRtSh

ID	Measured		Adjusted	
	X	Y	X	Y
Origin	206.248	200.685	-86.914	6.502
Rib_Lf	266.852	203.327	-26.289	9.976
Rib_Rt	212.268	198.171	-80.854	4.068
SpineTop	280.289	209.982	-12.931	16.823
SpineBot	284.277	201.066	-8.808	7.952
spine_bb	317.627	217.221	24.357	24.583
sternum	185.445	127.076	-106.689	-67.469
rt_shold	291.948	104.546	0.287	-88.623
rneckT	318.668	245.110	24.989	52.517
rneckB	318.414	177.368	25.734	-15.313
r1	297.764	306.019	3.162	113.169
r2	298.221	274.447	4.082	81.590
r3	318.338	273.583	24.238	81.008
r4	315.824	301.981	21.302	109.385

NAVAL BIODYNAMICS LABORATORY SOFTWARE DOCUMENTATION

r5	281.203	303.606	-13.380	110.520
r6	279.832	272.872	-14.305	79.756
r7	298.552	271.907	4.450	79.053
r8	298.247	301.117	3.717	108.272
c1	386.156	299.517	91.784	107.917
c2	386.080	274.701	92.081	83.079
c3	403.809	271.602	109.895	80.226
c4	402.768	296.977	108.468	105.610
c5	366.217	297.815	71.834	105.931
c6	365.455	272.847	71.444	80.933
c7	383.794	270.104	89.860	78.444
c8	383.388	295.427	89.072	103.785
l1	372.212	313.487	77.604	121.698
l2	373.050	282.194	78.913	90.395
l3	391.566	280.873	97.486	89.334
l4	390.525	310.591	95.994	119.061
l5	352.222	310.744	57.622	118.669
l6	350.647	280.873	56.489	88.757
l7	370.586	278.663	76.497	86.827
l8	369.875	308.204	75.342	116.378

Naval BioDynamics Laboratory PREP
Body Anthropometry for HRV # 00253

Page 10
Date: 10/08/92

Calibrated Fiducial Coordinates of Frame RtEyRtSh

Fid	X	Y
1	-193.950	148.160
2	-80.380	162.380
3	75.670	164.310
4	191.214	148.961
5	-193.920	-5.010
6	192.310	-4.800
7	-193.010	-159.210
8	-80.050	-147.600
9	75.390	-144.880
10	192.720	-158.520

Naval BioDynamics Laboratory PREP
Body Anthropometry for HRV # 00253

Page 11
Date: 10/08/92

Fiducial Measurements of Frame RtEyRtSh

ID	Measured	
	X	Y
2	191.770	344.272
3	347.193	350.647
4	462.991	338.658
5	83.033	173.711
6	468.249	185.293
8	201.092	34.976
9	356.235	42.723

8-Parameter Residuals of the Fiducial Coordinates

Fid	X	Y
2	0.153	-0.009

Anthropometry and Initial Conditions Photogrammetric Program

3	-0.191	0.034
4	0.098	0.077
5	-0.028	-0.026
6	-0.100	-0.192
8	-0.111	-0.032
9	0.175	0.148

Rms	0.133	0.098
Rms (check)	0.329	0.391

Transformation Parameters Are:

0.999771	0.029486	-282.0947	-0.000010	0.000005
-0.029919	1.000464	-176.3431		

Naval BioDynamics Laboratory PREP
Body Anthropometry for HRV # 00253

Page 12
Date: 10/08/92

Plate Coordinates for Frame RtEyRtSh

ID	Measured		Adjusted	
	X	Y	X	Y
Origin	134.137	188.671	-142.475	8.405
Rib_Lf	189.611	189.611	-87.014	7.690
Rib_Rt	139.954	183.007	-136.836	2.563
SpineTop	201.752	197.358	-74.642	15.085
SpineBot	212.700	189.738	-63.920	7.127
spine_bb	249.682	207.696	-26.382	24.012
sternum	114.097	111.735	-164.820	-68.008
rt_shold	241.376	95.606	-38.026	-88.080
lneckT	448.894	258.318	174.851	68.876
lneckB	448.818	175.539	172.400	-14.200
rneckT	260.883	236.753	-14.309	52.786
rneckB	263.627	169.037	-13.568	-15.141
r1	227.457	294.919	-46.027	111.989
r2	229.667	263.982	-44.737	80.963
r3	250.800	263.601	-23.606	79.966
r4	246.786	292.125	-26.776	108.635
r5	212.242	291.821	-61.332	109.327
r6	212.979	260.680	-61.525	78.145
r7	232.385	260.985	-42.108	77.884
r8	230.302	290.373	-43.317	107.357
c1	316.713	292.735	43.246	107.224
c2	317.805	267.614	43.604	82.030
c3	336.829	266.040	62.624	79.897
c4	334.467	291.490	61.000	105.464
c5	297.713	290.195	24.142	105.230
c6	298.577	265.405	24.278	80.378
c7	317.475	263.322	43.148	77.740
c8	316.078	288.442	42.484	102.944
l1	296.748	306.095	23.643	121.179
l2	299.364	275.488	25.363	90.454
l3	318.973	274.803	44.986	89.197
l4	316.332	304.038	43.196	118.555
l5	278.155	302.997	4.937	118.612
l6	278.790	272.745	4.680	88.306
l7	299.568	271.653	25.454	86.607
l8	297.002	300.330	23.728	115.399

Body Anthropometry Image Data File

LfEyLfSh	-838.200	1.000	1.000	
Origin	118.7074	14.0804		Photo LfEyLfSh
Rib Lf	118.3758	3.5684		Photo LfEyLfSh
*Rib Rt	69.3593	24.9248		Photo LfEyLfSh
SpineTop	32.0426	17.8235		Photo LfEyLfSh
SpineBot	28.0431	7.9459		Photo LfEyLfSh
spine_bb	2.7075	15.5963		Photo LfEyLfSh
sternum	130.4842	-81.4432		Photo LfEyLfSh
*lf_shold	29.7763	-90.6093		Photo LfEyLfSh
lneckT	10.0286	50.8605		Photo LfEyLfSh
lneckB	7.7974	-16.5859		Photo LfEyLfSh
rneckT	-180.0564	61.5182		Photo LfEyLfSh
rneckB	-181.5693	-20.5057		Photo LfEyLfSh
*r1	-65.1966	103.1791		Photo LfEyLfSh
r2	-64.5895	77.2160		Photo LfEyLfSh
r3	-56.5392	80.2299		Photo LfEyLfSh
r4	-55.0858	115.3023		Photo LfEyLfSh
*r5	-44.4719	100.5526		Photo LfEyLfSh
r6	-43.7825	75.0169		Photo LfEyLfSh
r7	-32.1149	78.8540		Photo LfEyLfSh
r8	-31.6877	113.1492		Photo LfEyLfSh
c1	-80.6856	100.9327		Photo LfEyLfSh
c2	-81.4819	74.4441		Photo LfEyLfSh
*c3	-75.0687	80.1321		Photo LfEyLfSh
*c4	-72.8086	113.5465		Photo LfEyLfSh
*c5	-61.0782	99.1489		Photo LfEyLfSh
*c6	-61.1016	73.8980		Photo LfEyLfSh
c7	-50.4732	78.6031		Photo LfEyLfSh
c8	-50.5188	109.6709		Photo LfEyLfSh
l1	5.8712	104.0517		Photo LfEyLfSh
l2	5.1286	75.7192		Photo LfEyLfSh
l3	24.5773	77.4904		Photo LfEyLfSh
l4	26.0571	106.3056		Photo LfEyLfSh
l5	24.5327	102.0173		Photo LfEyLfSh
l6	24.0535	74.7473		Photo LfEyLfSh
l7	44.5187	75.3447		Photo LfEyLfSh
l8	43.4507	104.2003		Photo LfEyLfSh

RtEyLfSh	-838.200	1.000	1.000	
Origin	35.1290	8.4642		Photo RtEyLfSh
Rib Lf	36.1826	-1.2707		Photo RtEyLfSh
Rib Rt	-12.8694	21.0015		Photo RtEyLfSh
SpineTop	-37.9129	19.6061		Photo RtEyLfSh
SpineBot	-42.6158	9.7926		Photo RtEyLfSh
spine_bb	-67.8802	16.8707		Photo RtEyLfSh
sternum	46.1639	-80.7238		Photo RtEyLfSh
*lf_shold	-28.3954	-90.2614		Photo RtEyLfSh
lneckT	-48.0064	51.6873		Photo RtEyLfSh
lneckB	-50.7060	-15.7700		Photo RtEyLfSh
*r1	-130.9705	104.1113		Photo RtEyLfSh
*r2	-130.3634	78.0729		Photo RtEyLfSh
*r3	-130.0745	82.1858		Photo RtEyLfSh
*r4	-128.2289	117.3177		Photo RtEyLfSh
*r5	-108.5759	101.5004		Photo RtEyLfSh
*r6	-107.9208	76.4045		Photo RtEyLfSh

Anthropometry and Initial Conditions Photogrammetric Program

r7	-104.5107	80.4776		Photo RtEyLfSh
r8	-103.4005	114.9166		Photo RtEyLfSh
c1	-144.9755	102.1329		Photo RtEyLfSh
c2	-145.6104	75.3767		Photo RtEyLfSh
*c3	-146.6254	81.9221		Photo RtEyLfSh
*c4	-144.7454	115.1035		Photo RtEyLfSh
*c5	-124.1269	99.9733		Photo RtEyLfSh
*c6	-124.0307	74.8475		Photo RtEyLfSh
*c7	-120.7261	80.1389		Photo RtEyLfSh
*c8	-120.8195	111.1259		Photo RtEyLfSh
11	-60.5933	105.0697		Photo RtEyLfSh
12	-61.5468	76.7790		Photo RtEyLfSh
13	-43.4213	78.3935		Photo RtEyLfSh
14	-42.0398	107.1388		Photo RtEyLfSh
15	-40.5516	102.7052		Photo RtEyLfSh
16	-41.3556	75.4077		Photo RtEyLfSh
17	-22.5213	76.1117		Photo RtEyLfSh
18	-23.2699	104.6938		Photo RtEyLfSh

LfEyRtSh	-838.200	1.000	1.000	
Origin	-86.9139	6.5021		Photo LfEyRtSh
Rib_Lf	-26.2886	9.9762		Photo LfEyRtSh
Rib_Rt	-80.8540	4.0678		Photo LfEyRtSh
SpineTop	-12.9312	16.8226		Photo LfEyRtSh
SpineBot	-8.8079	7.9518		Photo LfEyRtSh
spine_bb	24.3572	24.5835		Photo LfEyRtSh
sternum	-106.6885	-67.4695		Photo LfEyRtSh
*rt_shold	0.2868	-88.6234		Photo LfEyRtSh
rneckT	24.9890	52.5166		Photo LfEyRtSh
rneckB	25.7339	-15.3130		Photo LfEyRtSh
r1	3.1623	113.1687		Photo LfEyRtSh
r2	4.0824	81.5898		Photo LfEyRtSh
r3	24.2384	81.0082		Photo LfEyRtSh
r4	21.3020	109.3849		Photo LfEyRtSh
r5	-13.3797	110.5201		Photo LfEyRtSh
r6	-14.3051	79.7559		Photo LfEyRtSh
r7	4.4502	79.0529		Photo LfEyRtSh
r8	3.7172	108.2719		Photo LfEyRtSh
c1	91.7840	107.9168		Photo LfEyRtSh
c2	92.0813	83.0785		Photo LfEyRtSh
c3	109.8955	80.2257		Photo LfEyRtSh
c4	108.4676	105.6101		Photo LfEyRtSh
c5	71.8336	105.9312		Photo LfEyRtSh
c6	71.4438	80.9328		Photo LfEyRtSh
c7	89.8598	78.4445		Photo LfEyRtSh
c8	89.0715	103.7850		Photo LfEyRtSh
11	77.6038	121.6977		Photo LfEyRtSh
12	78.9127	90.3949		Photo LfEyRtSh
13	97.4861	89.3339		Photo LfEyRtSh
14	95.9944	119.0610		Photo LfEyRtSh
15	57.6219	118.6686		Photo LfEyRtSh
16	56.4894	88.7575		Photo LfEyRtSh
17	76.4972	86.8266		Photo LfEyRtSh
18	75.3420	116.3782		Photo LfEyRtSh

RtEyRtSh	-838.200	1.000	1.000	
Origin	-142.4749	8.4053		Photo RtEyRtSh
Rib_Lf	-87.0137	7.6897		Photo RtEyRtSh
Rib_Rt	-136.8364	2.5626		Photo RtEyRtSh

NAVAL BIODYNAMICS LABORATORY SOFTWARE DOCUMENTATION

SpineTop	-74.6417	15.0848	Photo	RtEyRtSh
SpineBot	-63.9205	7.1271	Photo	RtEyRtSh
spine_bb	-26.3823	24.0121	Photo	RtEyRtSh
sternum	-164.8196	-68.0076	Photo	RtEyRtSh
*rt_shold	-38.0261	-88.0801	Photo	RtEyRtSh
lneckT	174.8515	68.8762	Photo	RtEyRtSh
lneckB	172.3995	-14.2002	Photo	RtEyRtSh
rneckT	-14.3094	52.7858	Photo	RtEyRtSh
rneckB	-13.5676	-15.1412	Photo	RtEyRtSh
r1	-46.0271	111.9888	Photo	RtEyRtSh
r2	-44.7371	80.9632	Photo	RtEyRtSh
r3	-23.6062	79.9656	Photo	RtEyRtSh
r4	-26.7760	108.6349	Photo	RtEyRtSh
r5	-61.3325	109.3273	Photo	RtEyRtSh
r6	-61.5246	78.1450	Photo	RtEyRtSh
r7	-42.1077	77.8838	Photo	RtEyRtSh
r8	-43.3173	107.3571	Photo	RtEyRtSh
c1	43.2465	107.2244	Photo	RtEyRtSh
c2	43.6043	82.0303	Photo	RtEyRtSh
c3	62.6235	79.8974	Photo	RtEyRtSh
c4	60.9998	105.4642	Photo	RtEyRtSh
c5	24.1418	105.2303	Photo	RtEyRtSh
c6	24.2777	80.3777	Photo	RtEyRtSh
c7	43.1476	77.7396	Photo	RtEyRtSh
c8	42.4845	102.9435	Photo	RtEyRtSh
l1	23.6428	121.1788	Photo	RtEyRtSh
l2	25.3629	90.4545	Photo	RtEyRtSh
l3	44.9857	89.1972	Photo	RtEyRtSh
l4	43.1961	118.5550	Photo	RtEyRtSh
l5	4.9370	118.6117	Photo	RtEyRtSh
l6	4.6803	88.3057	Photo	RtEyRtSh
l7	25.4536	86.6072	Photo	RtEyRtSh
l8	23.7276	115.3987	Photo	RtEyRtSh

Anthropometry and Initial Conditions Photogrammetric Program

Head Anthropometry Prep Printed Output

Naval BioDynamics Laboratory PREP
Head Anthropometry for HRV # 00253

Page 1
Date: 08/05/92

Calibrated Fiducial Coordinates of Frame #1

Fid	X	Y
1	18.113	-12.126
2	18.105	12.126
3	-18.120	12.131
4	-18.105	-12.126

Calibrated Focal Length = -55.003 mm. Xoff= -0.005 mm. Yoff= -0.022 mm.

Lens Distortion

Radial Parameters
K0=+0.19243120D-03 K1=-0.28396730D-05 K2=+0.19404160D-07
K3=-0.47157530D-10

Naval BioDynamics Laboratory PREP
Head Anthropometry for HRV # 00253

Page 2
Date: 08/05/92

Fiducial Measurements of Frame #1

ID	Measured X	Y
1	14.468	4.869
2	14.617	11.777
3	4.328	11.964
4	4.146	5.124

8-Parameter Residuals of the Fiducial Coordinates

Fid	X	Y
1	0.000	0.000
2	0.000	0.000
3	0.000	0.000
4	0.000	0.000

Rms	0.000	0.000
Rms(check)	0.047	0.071

Transformation Parameters Are:

3.528078	-0.086591	-32.3087	0.000957	-0.000547
0.075706	3.542118	-30.6039		

NAVAL BIODYNAMICS LABORATORY SOFTWARE DOCUMENTATION

Naval BioDynamics Laboratory PREP
Head Anthropometry for HRV # 00253

Page 3
Date: 08/05/92

Plate Coordinates for Frame 1

	ID	Measured		Adjusted	
		X	Y	X	Y
Control:					
	a	5.272	10.869	-14.656	8.323
	j	8.747	11.635	-2.446	11.271
	k	8.391	8.316	-3.408	-0.489
	rtc1	7.900	5.947	-4.926	-8.881
	rtc2	7.229	5.924	-7.286	-9.018
	rtc3	7.150	6.242	-7.593	-7.904
	rtc4	7.808	6.262	-5.278	-7.779
	rtc5	7.853	5.354	-5.038	-10.973
	rtc6	7.195	5.332	-7.352	-11.107
Targets:					
	ear1-r	10.607	7.388	4.452	-3.588
	ear2-r	10.491	7.619	4.027	-2.784
	ear3-r	10.382	7.843	3.626	-2.004
	ear4-r	10.263	8.067	3.190	-1.224
	mrc1	11.455	7.861	7.381	-1.858
	mrc2	11.221	7.963	6.554	-1.517
	mrc3	11.150	8.075	6.296	-1.128
	mrc4	11.344	7.971	6.984	-1.479
	mrc5	11.314	7.632	6.907	-2.674
	mrc6	11.096	7.739	6.135	-2.315
	mcc1	11.668	8.567	8.068	0.643
	mcc2	11.457	8.685	7.321	1.043
	mcc3	11.367	8.774	6.998	1.349
	mcc4	11.571	8.686	7.719	1.055
	mcc5	11.533	8.351	7.614	-0.128

Naval BioDynamics Laboratory PREP
Head Anthropometry for HRV # 00253

Page 4
Date: 08/05/92

Calibrated Fiducial Coordinates of Frame #2

Fid	X	Y
1	18.116	-12.132
2	18.119	12.136
3	-18.126	12.139
4	-18.112	-12.132

Calibrated Focal Length = -55.003 mm. Xoff= +0.027 mm. Yoff= +0.088 mm.

Lens Distortion

Radial Parameters
K0=+0.64679230D-03 K1=-0.13013980D-04 K2=+0.76994240D-07
K3=-0.14139510D-09

Anthropometry and Initial Conditions Photogrammetric Program

Naval BioDynamics Laboratory PREP
Head Anthropometry for HRV # 00253

Page 5
Date: 08/05/92

Fiducial Measurements of Frame #2

ID	Measured	
	X	Y
1	14.584	4.916
2	14.637	11.765
3	4.488	11.838
4	4.260	5.003

8-Parameter Residuals of the Fiducial Coordinates

Fid	X	Y
1	0.000	0.000
2	0.000	0.000
3	0.000	0.000
4	0.000	0.000
Rms	0.000	0.000
Rms(check)	0.193	0.076

Transformation Parameters Are:

3.470361 -0.072014 -32.3217 0.000165 -0.002513
0.026816 3.477392 -29.4981

Naval BioDynamics Laboratory PREP
Head Anthropometry for HRV # 00253

Page 6
Date: 08/05/92

Plate Coordinates for Frame 2

	ID	Measured		Adjusted	
		X	Y	X	Y
Control:	a	6.106	10.643	-12.239	7.790
	b	6.999	10.754	-9.067	8.212
	c	6.227	7.958	-11.529	-1.778
	d	7.053	8.318	-8.642	-0.480
	j	13.249	10.696	13.186	8.167
	rtc1	6.568	6.787	-10.206	-5.901
	rtc2	6.148	6.883	-11.698	-5.575
	rtc3	6.472	7.050	-10.571	-4.978
	rtc4	6.878	6.946	-9.128	-5.333
	rtc5	6.598	6.307	-10.053	-7.588
	rtc6	6.171	6.402	-11.568	-7.266
	rtc8	6.890	6.465	-9.039	-7.024
	cen1	8.116	9.802	-5.006	4.882
	cen3	8.045	9.912	-5.268	5.224
	cen4	8.359	9.860	-4.147	5.046
	cen5	8.124	9.388	-4.942	3.355
	cen8	8.349	9.461	-4.150	3.622
	lfc5	8.813	9.897	-2.513	4.120
	lfc6	8.508	9.650	-3.600	4.300
Targets:					
	ron	10.424	8.389	3.288	-0.136

NAVAL BIODYNAMICS LABORATORY SOFTWARE DOCUMENTATION

ear1-r	9.135	7.384	-1.199	-3.728
ear2-r	9.211	7.569	-0.945	-3.073
ear3-r	9.293	7.762	-0.669	-2.388
ear4-r	9.366	7.952	-0.426	-1.714
mrc1	10.887	7.458	4.982	-3.417
mrc2	10.661	7.592	4.176	-2.950
mrc3	10.780	7.682	4.591	-2.629
mrc5	10.778	7.251	4.610	-4.150
mrc6	10.570	7.411	3.866	-3.592
mrc8	10.885	7.314	4.984	-3.925
mcc1	11.335	8.064	6.529	-1.262
mcc2	11.119	8.197	5.758	-0.797
mcc3	11.224	8.297	6.124	-0.440
mcc4	11.422	8.149	6.832	-0.959
mcc5	11.228	7.874	6.162	-1.938

Naval BioDynamics Laboratory PREP
Head Anthropometry for HRV # 00253

Page 7
Date: 08/05/92

Calibrated Fiducial Coordinates of Frame #3

Fid	X	Y
1	18.108	-12.122
2	18.110	12.124
3	-18.117	12.128
4	-18.107	-12.122

Calibrated Focal Length = -55.005 mm. Xoff= +0.037 mm. Yoff= +0.088 mm.

Lens Distortion

Radial Parameters
K0=+0.59205760D-03 K1=-0.11202800D-04 K2=+0.68771330D-07
K3=-0.13585810D-09

Naval BioDynamics Laboratory PREP
Head Anthropometry for HRV # 00253

Page 8
Date: 08/05/92

Fiducial Measurements of Frame #3

ID	Measured	
	X	Y
1	14.050	5.175
2	14.005	12.034
3	3.751	12.032
4	3.735	5.174

8-Parameter Residuals of the Fiducial Coordinates

Fid	X	Y
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Anthropometry and Initial Conditions Photogrammetric Program

1	0.000	0.000
2	0.000	0.000
3	0.000	0.000
4	0.000	0.000

Rms	0.000	0.000
Rms (check)	0.062	0.033

Transformation Parameters Are:

3.495096	0.006482	-31.1107	0.000017	-0.000903
-0.000593	3.508391	-30.2153		

Naval BioDynamics Laboratory PREP
Head Anthropometry for HRV # 00253

Page 9
Date: 08/05/92

Plate Coordinates for Frame 3

	ID	Measured	Adjusted	
		X Y	X Y	
Control:				
	a	8.308 10.640	-2.061 7.090	
	b	9.649 10.596	2.671 6.933	
	c	8.229 7.972	-2.352 -2.356	
	g	4.971 10.697	-13.836 7.294	
	h	10.930 10.803	7.193 7.666	
	rtc1	6.891 6.921	-7.062 -6.063	
	rtc2	6.810 7.107	-7.347 -5.407	
	rtc3	7.280 7.147	-5.694 -5.267	
	rtc4	7.388 6.963	-5.314 -5.915	
	rtc5	6.891 6.452	-7.061 -7.715	
	rtc6	6.774 6.624	-7.473 -7.109	
	rtc8	7.379 6.465	-5.346 -7.670	
	cen1	10.718 9.405	6.429 2.711	
	lfc1	12.009 9.436	10.978 2.819	
	lfc2	11.820 9.541	10.313 3.191	
	lfc3	12.195 9.550	11.635 3.223	
	lfc4	12.418 9.438	12.419 2.826	
	lfc5	11.974 9.000	10.847 1.276	
	lfc6	11.779 9.085	10.162 1.577	
	lfc8	12.378 9.000	12.270 1.276	
Targets:				
	ron	10.367 7.535	5.171 -3.900	
	lon	11.091 7.593	7.718 -3.695	
	ear1-r	8.442 6.876	-1.607 -6.223	
	ear2-r	8.680 7.032	-0.769 -5.674	
	ear3-r	8.922 7.201	0.083 -5.078	
	ear4-r	9.159 7.365	0.918 -4.500	
	ear1-l	12.246 7.044	11.772 -5.632	
	ear2-l	12.002 7.183	10.916 -5.141	
	ear3-l	11.758 7.308	10.060 -4.700	
	ear4-l	11.520 7.440	9.225 -4.235	
	mrc1	10.385 6.342	5.219 -8.104	
	mrc2	10.280 6.565	4.853 -7.319	
	mrc5	10.322 6.138	4.996 -8.822	
	mrc6	10.201 6.353	4.573 -8.065	

NAVAL BIODYNAMICS LABORATORY SOFTWARE DOCUMENTATION

mrc8	10.600	6.158	5.973	-8.752
mcc1	11.018	6.896	7.452	-6.153
mcc2	10.888	7.138	6.998	-5.300
mcc3	11.182	7.172	8.032	-5.180
mcc4	11.293	6.925	8.419	-6.051
mcc5	10.956	6.684	7.231	-6.900
mcc6	10.823	6.922	6.766	-6.061
mcc8	11.223	6.721	8.170	-6.769
mlc3	11.456	6.726	8.989	-6.752
mlc4	11.567	6.499	9.376	-7.551
mlc5	11.234	6.242	8.202	-8.456
mlc8	11.500	6.289	9.137	-8.291

Naval BioDynamics Laboratory PREP
Head Anthropometry for HRV # 00253

Page 10
Date: 08/05/92

Calibrated Fiducial Coordinates of Frame #4

Fid	X	Y
1	18.102	-12.127
2	18.110	12.118
3	-18.109	12.132
4	-18.124	-12.127

Calibrated Focal Length = -55.004 mm. Xoff= -0.056 mm. Yoff= +0.132 mm.

Lens Distortion

Radial Parameters
K0=+0.72422290D-03 K1=-0.13957730D-04 K2=+0.81529700D-07
K3=-0.14888030D-09

Naval BioDynamics Laboratory PREP
Head Anthropometry for HRV # 00253

Page 11
Date: 08/05/92

Fiducial Measurements of Frame #4

ID	Measured X	Y
1	14.080	5.698
2	14.062	12.516
3	3.849	12.604
4	3.790	5.714

8-Parameter Residuals of the Fiducial Coordinates

Fid	X	Y
1	0.000	0.000
2	0.000	0.000
3	0.000	0.000

Anthropometry and Initial Conditions Photogrammetric Program

4	0.000	0.000
Rms	0.000	0.000
Rms (check)	0.069	0.062

Transformation Parameters Are:

3.469922	-0.008782	-31.0518	-0.000952	-0.001033
0.017154	3.474843	-31.9335		

Naval BioDynamics Laboratory PREP
Head Anthropometry for HRV # 00253

Page 12
Date: 08/05/92

Plate Coordinates for Frame 4

	ID	Measured	Adjusted	
		X Y	X Y	
Control:	a	7.756 11.858	-4.272 9.460	
	b	9.236 11.789	0.968 9.255	
	d	9.252 9.104	1.047 -0.275	
	f	11.288 6.956	8.258 -7.839	
	g	6.416 11.952	-9.005 9.758	
	h	12.793 12.006	13.622 10.124	
	rtc1	5.687 8.169	-11.494 -3.630	
	rtc2	5.827 8.368	-11.007 -2.928	
	rtc3	6.311 8.362	-9.308 -2.942	
	rtc4	6.205 8.169	-9.676 -3.623	
	rtc5	5.739 7.680	-11.301 -5.350	
	rtc8	6.238 7.679	-9.551 -5.347	
	cen1	10.165 10.474	4.272 4.603	
	cen2	10.180 10.605	4.324 5.068	
	cen3	10.679 10.590	6.095 5.026	
	cen4	10.675 10.474	6.081 4.613	
	cen5	10.149 9.978	4.218 2.841	
	cen8	10.660 9.961	6.030 2.791	
	lfc1	11.720 10.457	9.793 4.575	
	lfc2	11.685 10.567	9.669 4.966	
	lfc3	12.179 10.572	11.427 4.995	
	lfc4	12.245 10.443	11.662 4.537	
	lfc5	11.701 9.959	9.725 2.804	
	lfc8	12.218 9.945	11.564 2.765	
Targets:	ron	7.549 8.508	-4.958 -2.409	
	lon	8.415 8.504	-1.905 -2.411	
	ear1-r	5.942 7.989	-10.595 -4.260	
	ear2-r	6.214 8.143	-9.644 -3.715	
	ear3-r	6.479 8.278	-8.716 -3.235	
	ear4-r	6.754 8.424	-7.753 -2.717	
	ear1-l	10.218 7.780	4.471 -4.943	
	ear2-l	9.953 7.954	3.533 -4.332	
	ear3-l	9.693 8.117	2.613 -3.760	
	ear4-l	9.434 8.291	1.696 -3.148	
	mrc1	7.225 7.253	-6.078 -6.835	
	mrc2	7.252 7.500	-5.987 -5.966	
	mrc5	7.260 7.044	-5.951 -7.570	
	mrc8	7.576 7.038	-4.841 -7.588	
	mcc1	7.645 7.781	-4.609 -4.972	

NAVAL BIODYNAMICS LABORATORY SOFTWARE DOCUMENTATION

mcc2	7.658	8.033	-4.567	-4.084
mcc3	8.003	8.046	-3.352	-4.033
mcc4	7.985	7.789	-3.412	-4.940
mcc5	7.687	7.561	-4.458	-5.746
mcc7	8.042	7.821	-3.212	-4.826
mcc8	8.027	7.568	-3.261	-5.718
mlc1	8.281	7.251	-2.363	-6.832
mlc3	8.621	7.531	-1.168	-5.842
mlc4	8.610	7.274	-1.204	-6.747
mlc5	8.314	7.056	-2.244	-7.518
mlc7	8.662	7.309	-1.021	-6.623
mlc8	8.636	7.066	-1.110	-7.479

Naval BioDynamics Laboratory PREP
Head Anthropometry for HRV # 00253

Page 13
Date: 08/05/92

Calibrated Fiducial Coordinates of Frame #5

Fid	X	Y
1	18.130	-12.125
2	18.123	12.136
3	-18.118	12.117
4	-18.106	-12.125

Calibrated Focal Length = -55.002 mm. Xoff= +0.013 mm. Yoff= +0.122 mm.

Lens Distortion

Radial Parameters
K0=+0.31260690D-03 K1=-0.76500290D-05 K2=+0.56783210D-07
K3=-0.12129480D-09

Naval BioDynamics Laboratory PREP
Head Anthropometry for HRV # 00253

Page 14
Date: 08/05/92

Fiducial Measurements of Frame #5

ID	Measured	
	X	Y
1	14.162	5.077
2	14.136	11.949
3	3.842	11.871
4	3.869	5.051

8-Parameter Residuals of the Fiducial Coordinates

Fid	X	Y
1	0.000	0.000

Anthropometry and Initial Conditions Photogrammetric Program

2	0.000	0.000
3	0.000	0.000
4	0.000	0.000

Rms	0.000	0.000
Rms (check)	0.037	0.067

Transformation Parameters Are:

3.541999	0.012342	-31.9213	0.000664	0.000018
-0.017068	3.564324	-30.0959		

Naval BioDynamics Laboratory PREP
Head Anthropometry for HRV # 00253

Page 15
Date: 08/05/92

Plate Coordinates for Frame 5

	ID	Measured X	Y	Adjusted X	Y
Control:	b	10.896	11.654	6.753	11.052
	c	9.645	9.043	2.325	1.837
	d	10.777	8.689	6.300	0.564
	f	10.960	5.820	6.907	-9.591
	cen1	11.029	10.034	7.200	5.318
	cen2	11.402	10.146	8.511	5.706
	cen3	11.867	10.024	10.141	5.265
	cen4	11.482	9.913	8.789	4.880
	cen5	10.991	9.488	7.060	3.387
	cen8	11.448	9.340	8.662	2.854
	lfc1	12.479	9.641	12.282	3.899
	lfc2	12.852	9.773	13.591	4.358
	lfc3	13.375	9.641	15.420	3.881
	lfc4	13.006	9.508	14.127	3.419
	lfc5	12.426	9.059	12.089	1.843
	lfc7	13.339	9.041	15.287	1.763
	lfc8	12.949	8.900	13.920	1.272
Targets:	lon	6.377	8.628	-9.200	0.424
	ear1-r	5.552	8.666	-12.116	0.573
	ear2-r	5.740	8.731	-11.450	0.801
	ear1-l	8.036	7.346	-3.362	-4.150
	ear2-l	7.932	7.599	-3.726	-3.252
	ear3-l	7.817	7.844	-4.128	-2.381
	ear4-l	7.704	8.080	-4.524	-1.542
	mcc1	5.056	8.213	-13.877	-1.027
	mcc2	5.284	8.425	-13.067	-0.278
	mcc3	5.480	8.360	-12.375	-0.512
	mcc4	5.246	8.143	-13.205	-1.279
	mcc5	5.205	7.986	-13.353	-1.836
	mcc7	5.624	8.132	-11.868	-1.324
	mcc8	5.401	7.905	-12.660	-2.127
	mlc1	5.729	7.522	-11.504	-3.492
	mlc2	5.951	7.737	-10.717	-2.732
	mlc3	6.141	7.652	-10.046	-3.036
	mlc4	5.915	7.441	-10.848	-3.782

NAVAL BIODYNAMICS LABORATORY SOFTWARE DOCUMENTATION

mlc5	5.878	7.290	-10.980	-4.317
mlc7	6.295	7.441	-9.505	-3.787
mlc8	6.065	7.232	-10.320	-4.526

Naval BioDynamics Laboratory PREP
Head Anthropometry for HRV # 00253

Page 16
Date: 08/05/92

Calibrated Fiducial Coordinates of Frame #6

Fid	X	Y
1	18.105	-12.122
2	18.111	12.127
3	-18.134	12.141
4	-18.105	-12.122

Calibrated Focal Length = -55.005 mm. Xoff= +0.045 mm. Yoff= +0.036 mm.

Lens Distortion

Radial Parameters
K0=+0.72083470D-03 K1=-0.13284430D-04 K2=+0.79422490D-07
K3=-0.15412240D-09

Naval BioDynamics Laboratory PREP
Head Anthropometry for HRV # 00253

Page 17
Date: 08/05/92

Fiducial Measurements of Frame #6

ID	Measured	
	X	Y
1	13.479	5.731
2	13.487	12.568
3	3.246	12.600
4	3.209	5.750

8-Parameter Residuals of the Fiducial Coordinates

Fid	X	Y
1	0.000	0.000
2	0.000	0.000
3	0.000	0.000
4	0.000	0.000
Rms	0.000	0.000
Rms(check)	0.041	0.031

Transformation Parameters Are:

3.510959	-0.013339	-29.2288	-0.000120	-0.000549
0.008223	3.523136	-32.3652		

Anthropometry and Initial Conditions Photogrammetric Program

Naval BioDynamics Laboratory PREP
Head Anthropometry for HRV # 00253

Page 18
Date: 08/05/92

Plate Coordinates for Frame 6

	ID	Measured		Adjusted	
		X	Y	X	Y
Control:	b	13.038	11.118	16.473	6.927
	rtc1	9.827	8.701	5.145	-1.676
	rtc2	10.437	8.651	7.300	-1.848
	rtc3	10.409	8.388	7.204	-2.780
	rtc4	9.790	8.438	5.017	-2.608
	rtc7	10.374	7.818	7.085	-4.799
	rtc8	9.805	7.870	5.076	-4.620
	cen1	11.320	8.752	10.418	-1.483
	cen2	12.234	8.677	13.649	-1.741
	cen3	12.268	8.272	13.772	-3.176
	cen4	11.303	8.351	10.361	-2.904
	cen8	11.230	7.524	10.110	-5.833
	lfc1	11.232	7.462	10.117	-6.052
	lfc2	12.321	7.348	13.964	-6.447
	lfc3	12.344	6.787	14.047	-8.431
	lfc4	11.189	6.901	9.970	-8.037
	lfc7	12.218	5.845	13.602	-11.757
	lfc8	11.105	5.958	9.681	-11.371
Targets:	ear1-1	5.411	7.091	-10.418	-7.408
	ear2-1	5.617	7.410	-9.697	-6.278
	ear3-1	5.844	7.720	-8.903	-5.180
	ear4-1	6.036	8.018	-8.231	-4.124
	mcc1	4.382	9.228	-14.091	0.147
	mcc2	4.661	9.350	-13.108	0.582
	mcc3	4.576	9.210	-13.406	0.085
	mcc4	4.255	9.093	-14.536	-0.332
	mcc8	4.422	8.786	-13.940	-1.418
	mlc1	4.577	8.270	-13.382	-3.244
	mlc3	4.767	8.247	-12.712	-3.323
	mlc4	4.464	8.125	-13.778	-3.758
	mlc7	4.943	7.941	-12.085	-4.405
	mlc8	4.630	7.807	-13.186	-4.882

Head Anthropometry Image Data File

5.87500	5.81250	0.055	#1-580	
#1	-55.003	0.055	Photo	#1
a	-14.6561	8.3229	Photo	#1
j	-2.4462	11.2708	Photo	#1
k	-3.4083	-0.4887	Photo	#1
rtc1	-4.9258	-8.8809	Photo	#1
rtc2	-7.2857	-9.0182	Photo	#1
rtc3	-7.5927	-7.9039	Photo	#1
rtc4	-5.2776	-7.7789	Photo	#1
rtc5	-5.0384	-10.9729	Photo	#1
rtc6	-7.3519	-11.1068	Photo	#1
ear1-r	4.4523	-3.5880	Photo	#1
ear2-r	4.0266	-2.7841	Photo	#1
ear3-r	3.6258	-2.0039	Photo	#1
ear4-r	3.1898	-1.2241	Photo	#1
mrc1	7.3812	-1.8577	Photo	#1
mrc2	6.5542	-1.5168	Photo	#1
mrc3	6.2965	-1.1281	Photo	#1
mrc4	6.9839	-1.4792	Photo	#1
mrc5	6.9068	-2.6742	Photo	#1
mrc6	6.1352	-2.3147	Photo	#1
mcc1	8.0685	0.6428	Photo	#1
mcc2	7.3207	1.0425	Photo	#1
mcc3	6.9984	1.3493	Photo	#1
mcc4	7.7194	1.0545	Photo	#1
mcc5	7.6139	-0.1276	Photo	#1

#2	-55.003	0.055	0.055 #2-736	
* a	-12.2394	7.7903	Photo	#2
b	-9.0674	8.2118	Photo	#2
c	-11.5294	-1.7780	Photo	#2
d	-8.6416	-0.4798	Photo	#2
* j	13.1862	8.1672	Photo	#2
rtc1	-10.2061	-5.9014	Photo	#2
rtc2	-11.6981	-5.5755	Photo	#2
rtc3	-10.5711	-4.9781	Photo	#2
rtc4	-9.1278	-5.3331	Photo	#2
* rtc5	-10.0529	-7.5876	Photo	#2
rtc6	-11.5678	-7.2664	Photo	#2
rtc8	-9.0391	-7.0244	Photo	#2
cen1	-5.0059	4.8324	Photo	#2
cen3	-5.2677	5.2235	Photo	#2
cen4	-4.1473	5.0464	Photo	#2
cen5	-4.9422	3.3550	Photo	#2
cen8	-4.1495	3.6216	Photo	#2
lfc5	-2.5127	4.1197	Photo	#2
lfc6	-3.6005	4.3004	Photo	#2
ron	3.2881	-0.1357	Photo	#2
ear1-r	-1.1992	-3.7278	Photo	#2
ear2-r	-0.9448	-3.0725	Photo	#2
ear3-r	-0.6695	-2.3880	Photo	#2
ear4-r	-0.4255	-1.7137	Photo	#2
mrc1	4.9823	-3.4171	Photo	#2
mrc2	4.1764	-2.9505	Photo	#2
mrc3	4.5911	-2.6291	Photo	#2

Anthropometry and Initial Conditions Photogrammetric Program

mrc5	4.6101	-4.1503		Photo	#2
mrc6	3.8664	-3.5920		Photo	#2
mrc8	4.9838	-3.9251		Photo	#2
mcc1	6.5291	-1.2623		Photo	#2
mcc2	5.7582	-0.7973		Photo	#2
mcc3	6.1236	-0.4400		Photo	#2
mcc4	6.8317	-0.9589		Photo	#2
mcc5	6.1619	-1.9376		Photo	#2

#3	-55.005	0.055	0.055	#3-674	
a	-2.0609	7.0902		Photo	#3
b	2.6711	6.9331		Photo	#3
c	-2.3523	-2.3564		Photo	#3
* g	-13.8361	7.2936		Photo	#3
* h	7.1930	7.6657		Photo	#3
rtc1	-7.0615	-6.0627		Photo	#3
rtc2	-7.3465	-5.4070		Photo	#3
rtc3	-5.6936	-5.2666		Photo	#3
rtc4	-5.3140	-5.9154		Photo	#3
rtc5	-7.0613	-7.7149		Photo	#3
rtc6	-7.4727	-7.1090		Photo	#3
rtc8	-5.3460	-7.6696		Photo	#3
cen1	6.4287	2.7106		Photo	#3
lfc1	10.9777	2.8190		Photo	#3
lfc2	10.3134	3.1909		Photo	#3
lfc3	11.6352	3.2225		Photo	#3
lfc4	12.4192	2.8258		Photo	#3
lfc5	10.8473	1.2760		Photo	#3
lfc6	10.1618	1.5768		Photo	#3
lfc8	12.2705	1.2757		Photo	#3
ron	5.1706	-3.8999		Photo	#3
lon	7.7181	-3.6950		Photo	#3
ear1-r	-1.6074	-6.2233		Photo	#3
ear2-r	-0.7694	-5.6737		Photo	#3
ear3-r	0.0830	-5.0781		Photo	#3
ear4-r	0.9182	-4.4998		Photo	#3
ear1-l	11.7717	-5.6316		Photo	#3
ear2-l	10.9159	-5.1414		Photo	#3
ear3-l	10.0597	-4.7005		Photo	#3
ear4-l	9.2247	-4.2348		Photo	#3
mrc1	5.2194	-8.1040		Photo	#3
mrc2	4.8530	-7.3189		Photo	#3
mrc5	4.9956	-8.8219		Photo	#3
mrc6	4.5729	-8.0653		Photo	#3
mrc8	5.9727	-8.7516		Photo	#3
mcc1	7.4515	-6.1528		Photo	#3
mcc2	6.9978	-5.2999		Photo	#3
mcc3	8.0320	-5.1799		Photo	#3
mcc4	8.4187	-6.0506		Photo	#3
mcc5	7.2306	-6.8997		Photo	#3
mcc6	6.7663	-6.0612		Photo	#3
mcc8	8.1697	-6.7694		Photo	#3
mlc3	8.9888	-6.7518		Photo	#3
mlc4	9.3756	-7.5514		Photo	#3
mlc5	7.2016	-8.4561		Photo	#3
mlc8	7.1370	-8.2908		Photo	#3

#4	-55.004	0.055	0.055	#4-623	
a	-4.2721	9.4603		Photo	#4

NAVAL BIODYNAMICS LABORATORY SOFTWARE DOCUMENTATION

	b	0.9680	9.2549	Photo	#4
	d	1.0467	-0.2746	Photo	#4
	f	8.2583	-7.8387	Photo	#4
*	g	-9.0048	9.7582	Photo	#4
*	h	13.6216	10.1241	Photo	#4
	rtc1	-11.4936	-3.6303	Photo	#4
	rtc2	-11.0066	-2.9276	Photo	#4
	rtc3	-9.3077	-2.9418	Photo	#4
	rtc4	-9.6761	-3.6231	Photo	#4
	rtc5	-11.3011	-5.3500	Photo	#4
	rtc8	-9.5508	-5.3473	Photo	#4
	cen1	4.2716	4.6027	Photo	#4
	cen2	4.3240	5.0684	Photo	#4
	cen3	6.0947	5.0258	Photo	#4
	cen4	6.0809	4.6134	Photo	#4
	cen5	4.2176	2.8411	Photo	#4
	cen8	6.0296	2.7907	Photo	#4
	lfc1	9.7933	4.5752	Photo	#4
	lfc2	9.6689	4.9658	Photo	#4
	lfc3	11.4271	4.9947	Photo	#4
	lfc4	11.6617	4.5369	Photo	#4
	lfc5	9.7253	2.8040	Photo	#4
	lfc8	11.5639	2.7647	Photo	#4
	ron	-4.9580	-2.4093	Photo	#4
	lon	-1.9052	-2.4108	Photo	#4
	ear1-r	-10.5954	-4.2603	Photo	#4
	ear2-r	-9.6440	-3.7145	Photo	#4
	ear3-r	-8.7163	-3.2354	Photo	#4
	ear4-r	-7.7529	-2.7170	Photo	#4
	ear1-l	4.4710	-4.9426	Photo	#4
	ear2-l	3.5332	-4.3317	Photo	#4
	ear3-l	2.6131	-3.7595	Photo	#4
	ear4-l	1.6963	-3.1484	Photo	#4
	mrc1	-6.0777	-6.8351	Photo	#4
	mrc2	-5.9869	-5.9658	Photo	#4
	mrc5	-5.9513	-7.5698	Photo	#4
	mrc8	-4.8406	-7.5879	Photo	#4
	mcc1	-4.6091	-4.9719	Photo	#4
	mcc2	-4.5671	-4.0836	Photo	#4
	mcc3	-3.3523	-4.0334	Photo	#4
	mcc4	-3.4122	-4.9398	Photo	#4
	mcc5	-4.4581	-5.7464	Photo	#4
	mcc7	-3.2119	-4.8263	Photo	#4
	mcc8	-3.2613	-5.7180	Photo	#4
	mlc1	-2.3627	-6.8317	Photo	#4
	mlc3	-1.1677	-5.8417	Photo	#4
	mlc4	-1.2037	-6.7473	Photo	#4
	mlc5	-2.2441	-7.5177	Photo	#4
	mlc7	-1.0208	-6.6234	Photo	#4
	mlc8	-1.1099	-7.4794	Photo	#4

	#5	-55.002	0.055	0.055 #5-591	#5
	b	6.7533	11.0523	Photo	#5
	c	2.3252	1.8373	Photo	#5
	d	6.2996	0.5637	Photo	#5
	f	6.9070	-9.5909	Photo	#5
	cen1	7.2002	5.3176	Photo	#5
	cen2	8.5108	5.7060	Photo	#5
	cen3	10.1407	5.2651	Photo	#5

Anthropometry and Initial Conditions Photogrammetric Program

cen4	8.7887	4.8803	Photo	#5
cen5	7.0604	3.3868	Photo	#5
cen8	8.6625	2.8544	Photo	#5
lfc1	12.2821	3.8990	Photo	#5
lfc2	13.5909	4.3583	Photo	#5
lfc3	15.4201	3.8815	Photo	#5
lfc4	14.1271	3.4189	Photo	#5
lfc5	12.0891	1.8428	Photo	#5
lfc7	15.2873	1.7627	Photo	#5
lfc8	13.9201	1.2715	Photo	#5
lon	-9.2001	0.4239	Photo	#5
ear1-r	-12.1160	0.5732	Photo	#5
ear2-r	-11.4502	0.8006	Photo	#5
ear1-l	-3.3622	-4.1501	Photo	#5
ear2-l	-3.7259	-3.2516	Photo	#5
ear3-l	-4.1284	-2.3811	Photo	#5
ear4-l	-4.5240	-1.5424	Photo	#5
mcc1	-13.8771	-1.0273	Photo	#5
mcc2	-13.0674	-0.2781	Photo	#5
mcc3	-12.3746	-0.5122	Photo	#5
mcc4	-13.2054	-1.2790	Photo	#5
mcc5	-13.3525	-1.8360	Photo	#5
mcc7	-11.8680	-1.3241	Photo	#5
mcc8	-12.6599	-2.1267	Photo	#5
mlc1	-11.5044	-3.4916	Photo	#5
mlc2	-10.7166	-2.7316	Photo	#5
mlc3	-10.0461	-3.0362	Photo	#5
mlc4	-10.8477	-3.7819	Photo	#5
mlc5	-10.9804	-4.3174	Photo	#5
mlc7	-9.5046	-3.7873	Photo	#5
mlc8	-10.3200	-4.5259	Photo	#5

#6	-55.005	0.055	0.055	#6-806
* b	16.4732	6.9266	Photo	#6
rtc1	5.1453	-1.6760	Photo	#6
rtc2	7.3002	-1.8480	Photo	#6
rtc3	7.2036	-2.7801	Photo	#6
rtc4	5.0172	-2.6084	Photo	#6
rtc7	7.0849	-4.7990	Photo	#6
rtc8	5.0756	-4.6199	Photo	#6
* cen1	10.4182	-1.4826	Photo	#6
cen2	13.6490	-1.7410	Photo	#6
cen3	13.7715	-3.1759	Photo	#6
cen4	10.3611	-2.9036	Photo	#6
cen8	10.1095	-5.8326	Photo	#6
* lfc1	10.1170	-6.0520	Photo	#6
lfc2	13.9637	-6.4472	Photo	#6
* lfc3	14.0469	-8.4311	Photo	#6
lfc4	9.9697	-8.0371	Photo	#6
* lfc7	13.6024	-11.7572	Photo	#6
lfc8	9.6807	-11.3713	Photo	#6
ear1-l	-10.4178	-7.4077	Photo	#6
ear2-l	-9.6974	-6.2782	Photo	#6
ear3-l	-8.9027	-5.1801	Photo	#6
ear4-l	-8.2312	-4.1243	Photo	#6
mcc1	-14.0906	0.1473	Photo	#6
mcc2	-13.1084	0.5819	Photo	#6
mcc3	-13.4055	0.0852	Photo	#6
mcc4	-14.5359	-0.3320	Photo	#6

NAVAL BIODYNAMICS LABORATORY SOFTWARE DOCUMENTATION

mcc8	-13.9401	-1.4180	Photo	#6
mlc1	-13.3825	-3.2436	Photo	#6
mlc3	-12.7118	-3.3235	Photo	#6
mlc4	-13.7781	-3.7577	Photo	#6
mlc7	-12.0847	-4.4050	Photo	#6
mlc8	-13.1860	-4.8815	Photo	#6

Anthropometry and Initial Conditions Photogrammetric Program

Initial Conditions Image Data File

#1	-55.003	0.025	0.025	#1-580	
a	4.0733	-5.9268		Photo	#1
b	3.9411	-7.5439		Photo	#1
c	9.0001	-9.5576		Photo	#1
rtc1	-3.6518	-6.6810		Photo	#1
rtc2	-5.2639	-7.0111		Photo	#1
rtc3	-5.7427	-6.0392		Photo	#1
rtc4	-4.0975	-5.8006		Photo	#1
rtc5	-3.6487	-8.0633		Photo	#1
rtc6	-5.2854	-8.3587		Photo	#1
* cen1	-7.9262	4.3394		Photo	#1
cen2	-9.1381	4.2633		Photo	#1
* cen3	-9.4991	4.7138		Photo	#1
* cen5	-7.8691	3.1781		Photo	#1
cen6	-9.1218	3.0239		Photo	#1
* cen7	-8.9064	5.6385		Photo	#1
* lfc1	-10.4299	5.9394		Photo	#1
* lfc2	-9.2076	6.0824		Photo	#1
* lfc4	-10.0573	4.3687		Photo	#1
* lfc6	-10.0467	4.3687		Photo	#1
lfc7	-10.3618	4.7877		Photo	#1
m_r1	2.9145	2.1257		Photo	#1
m_r4	2.6727	2.4417		Photo	#1
m_t1	3.4948	4.3627		Photo	#1
m_t4	3.2826	4.5451		Photo	#1
m_b1	3.8175	3.0954		Photo	#1
m_b4	3.5655	3.3903		Photo	#1
mtar01	2.5248	1.9018		Photo	#1
mtar03	3.1365	4.1496		Photo	#1
mtar06	2.5579	2.3742		Photo	#1
mtar07	3.1597	4.5657		Photo	#1
mtar11	3.4749	3.3476		Photo	#1

#2	-55.003	0.025	0.025	#2-736	
a	-2.0814	-5.0775		Photo	#2
b	-1.9430	-6.7281		Photo	#2
c	6.1033	-11.7813		Photo	#2
rtc1	-10.1376	-2.8134		Photo	#2
rtc2	-11.4042	-2.6223		Photo	#2
rtc3	-10.6560	-1.7977		Photo	#2
rtc4	-9.3077	-2.1061		Photo	#2
rtc5	-9.9028	-4.1039		Photo	#2
rtc6	-11.2055	-3.8221		Photo	#2
rtc8	-9.1322	-3.3717		Photo	#2
m_r1	3.4502	2.3454		Photo	#2
m_r4	3.6971	2.6581		Photo	#2
m_t1	5.5357	4.3027		Photo	#2
m_t4	5.7714	4.5703		Photo	#2
m_b1	5.9624	2.9070		Photo	#2
m_b4	6.1916	3.1990		Photo	#2
mtar01	3.0404	2.2183		Photo	#2
mtar03	5.1160	4.2004		Photo	#2
mtar06	3.3248	2.6526		Photo	#2
mtar07	5.3872	4.6529		Photo	#2
mtar09	5.5177	4.1245		Photo	#2

NAVAL BIODYNAMICS LABORATORY SOFTWARE DOCUMENTATION

mtar11	5.7814	3.1909		Photo	#2

#3	-55.005	0.025	0.025	#3-674	
a	-11.1395	-3.1387		Photo	#3
b	-10.9820	-4.7801		Photo	#3
d	6.4082	-0.5924		Photo	#3
e	6.2630	-1.9408		Photo	#3
f	-6.8496	11.5518		Photo	#3
rtc1	-14.4433	1.1240		Photo	#3
rtc2	-14.8350	1.6272		Photo	#3
rtc3	-13.5483	1.9610		Photo	#3
rtc4	-13.1546	1.3412		Photo	#3
rtc5	-14.2932	-0.0966		Photo	#3
rtc6	-14.6648	0.3177		Photo	#3
rtc8	-13.0006	0.1735		Photo	#3
cen1	2.4712	5.4102		Photo	#3
cen2	1.8198	5.8215		Photo	#3
cen3	2.8532	6.0024		Photo	#3
cen4	3.5179	5.5591		Photo	#3
cen5	2.3619	4.2667		Photo	#3
cen6	1.7245	4.6636		Photo	#3
cen8	3.4020	4.4511		Photo	#3
lfc1	5.5028	5.9217		Photo	#3
lfc2	4.8271	6.3123		Photo	#3
lfc3	5.7899	6.5081		Photo	#3
lfc4	6.4828	6.1138		Photo	#3
lfc5	5.4117	4.8453		Photo	#3
lfc6	4.7320	5.1934		Photo	#3
lfc8	6.3835	4.9739		Photo	#3
m_r1	-2.3092	1.3017		Photo	#3
m_r4	-1.6742	1.4210		Photo	#3
m_t1	0.2279	2.5063		Photo	#3
m_t4	0.8300	2.5517		Photo	#3
m_b1	0.3891	0.8726		Photo	#3
m_b4	1.0244	1.0201		Photo	#3
m_l1	1.2089	2.0383		Photo	#3
m_l4	1.8647	2.1501		Photo	#3
mtar01	-2.5338	1.3328		Photo	#3
mtar03	-0.0295	2.4672		Photo	#3
mtar06	-2.1599	1.6390		Photo	#3
mtar07	0.4083	2.8008		Photo	#3
mtar08	1.4039	2.3643		Photo	#3
mtar09	0.4882	2.2840		Photo	#3
mtar11	0.5680	1.2977		Photo	#3

#4	-55.004	0.025	0.025	#4-623	
a	-10.8802	0.1685		Photo	#4
b	-10.7169	-1.3150		Photo	#4
c	-12.2148	-9.4314		Photo	#4
d	7.0628	-4.9962		Photo	#4
e	6.9465	-6.4794		Photo	#4
f	15.8636	9.4537		Photo	#4
rtc1	-8.2459	4.0027		Photo	#4
rtc2	-7.6466	4.4882		Photo	#4
rtc3	-6.6605	4.3339		Photo	#4
rtc4	-7.2072	3.8594		Photo	#4
rtc5	-8.1876	2.9329		Photo	#4
cen1	7.4741	2.5460		Photo	#4
cen2	7.7964	3.1067		Photo	#4

Anthropometry and Initial Conditions Photogrammetric Program

cen3	9.1135	2.8838	Photo	#4
cen4	8.8578	2.3307	Photo	#4
cen5	7.3223	1.3686	Photo	#4
cen7	8.9790	1.6500	Photo	#4
cen8	8.6777	1.0756	Photo	#4
lfc1	11.5555	1.8434	Photo	#4
lfc2	11.8081	2.4318	Photo	#4
lfc3	13.2140	2.2240	Photo	#4
lfc4	12.9576	1.6321	Photo	#4
lfc5	11.4202	0.6242	Photo	#4
lfc7	13.0290	0.8806	Photo	#4
lfc8	12.8043	0.3916	Photo	#4
m_r1	-5.0743	1.4645	Photo	#4
m_r4	-4.4616	1.3635	Photo	#4
m_t1	-3.9433	1.9328	Photo	#4
m_t4	-3.2705	1.8217	Photo	#4
m_b1	-4.1263	0.3528	Photo	#4
m_b4	-3.4711	0.1992	Photo	#4
m_l1	-1.5165	0.8221	Photo	#4
m_l4	-0.8750	0.6753	Photo	#4
mtar06	-4.6532	1.7187	Photo	#4
mtar07	-3.4727	2.1945	Photo	#4
mtar08	-1.0737	1.0482	Photo	#4
mtar09	-3.5618	1.6216	Photo	#4
mtar11	-3.6944	0.5716	Photo	#4

#5	-55.002	0.025	0.025	#5-591
c	-8.8750	-5.0654	Photo	#5
d	4.0198	-7.8227	Photo	#5
e	3.9235	-9.3762	Photo	#5
g	-5.4097	6.2945	Photo	#5
h	-16.6844	7.7931	Photo	#5
i	-17.2372	-6.0178	Photo	#5
cen1	9.4364	-0.7460	Photo	#5
cen2	10.7194	-0.4372	Photo	#5
cen3	11.6261	-1.1107	Photo	#5
cen4	10.3335	-1.4512	Photo	#5
cen5	9.2890	-2.0696	Photo	#5
cen7	11.4679	-2.4721	Photo	#5
cen8	10.1681	-2.7531	Photo	#5
lfc1	12.2063	-2.8692	Photo	#5
lfc2	13.5391	-2.4966	Photo	#5
lfc3	14.5771	-3.2857	Photo	#5
lfc4	13.2244	-3.6481	Photo	#5
lfc5	12.0106	-4.2997	Photo	#5
lfc7	14.3491	-4.7190	Photo	#5
lfc8	13.0245	-5.0461	Photo	#5
m_t1	-3.9025	2.9597	Photo	#5
m_t4	-3.6723	2.6868	Photo	#5
m_b1	-4.3260	1.5544	Photo	#5
m_b4	-4.0812	1.2501	Photo	#5
m_l1	-1.8748	1.1264	Photo	#5
m_l4	-1.6664	0.8678	Photo	#5
mtar07	-3.5228	3.0140	Photo	#5
mtar08	-1.4640	1.1882	Photo	#5
mtar11	-3.9256	1.6231	Photo	#5

NAVAL BIODYNAMICS LABORATORY SOFTWARE DOCUMENTATION

Site Survey Image Data File

#1	-55.003	0.020	0.020	#1-580	
lfc1	-5.7949	5.1351		Photo	#1
lfc3	-7.2231	5.4386		Photo	#1
lfc4	-6.0735	5.5303		Photo	#1
lfc6	-6.9536	3.9166		Photo	#1
c1	-4.8557	3.8962		Photo	#1
c2	-6.0864	3.7907		Photo	#1
c3	-6.3834	4.2044		Photo	#1
c4	-5.1808	4.3112		Photo	#1
c5	-4.8583	2.7129		Photo	#1
xc6	-5.0768	2.6152		Photo	#1
c7	-6.3904	3.0784		Photo	#1
a	6.7072	-6.5844		Photo	#1
b	6.5145	-8.2130		Photo	#1
xc	11.6547	-10.4506		Photo	#1
rtc1	-0.9865	-7.0918		Photo	#1
rtc2	-2.5984	-7.3229		Photo	#1
rtc3	-3.0437	-6.3967		Photo	#1
rtc6	-2.6446	-8.7351		Photo	#1
rtc7	-3.0631	-7.6721		Photo	#1
sp1	-0.8812	-5.6827		Photo	#1
sp2	-2.5547	-5.8857		Photo	#1
sp3	-2.9929	-4.9675		Photo	#1
sp4	-1.3947	-4.7651		Photo	#1
x+12	7.2373	-4.8752		Photo	#1
x+18	11.5754	-4.3390		Photo	#1
xx+24	15.6944	-3.8774		Photo	#1
y+12	-4.4051	-1.0836		Photo	#1
y+06	-3.2994	-3.3892		Photo	#1
y-06	-0.4486	-9.1017		Photo	#1
z+06	-1.7586	-1.6685		Photo	#1
z+12	-1.4802	3.1523		Photo	#1

#2	-55.003	0.020	0.020	#2-736	
lfc1	3.2714	6.5929		Photo	#2
lfc2	2.2186	6.7366		Photo	#2
lfc3	2.6764	7.0876		Photo	#2
lfc4	3.7063	6.9384		Photo	#2
lfc5	3.2801	5.5026		Photo	#2
c1	1.9758	5.4892		Photo	#2
c2	0.8648	5.6429		Photo	#2
c3	1.3386	6.0013		Photo	#2
c4	2.4146	5.8469		Photo	#2
c5	1.9674	4.3411		Photo	#2
c6	0.8650	4.5092		Photo	#2
c8	2.4153	4.7473		Photo	#2
a	-0.0328	-5.9851		Photo	#2
b	0.0327	-7.6305		Photo	#2
d	7.4512	1.1925		Photo	#2
e	7.3906	-0.0977		Photo	#2
rtc1	-7.9120	-3.4810		Photo	#2
rtc2	-9.1450	-3.2010		Photo	#2
rtc4	-7.0908	-2.7661		Photo	#2
rtc6	-8.9672	-4.4653		Photo	#2
rtc8	-6.9507	-4.0293		Photo	#2

Anthropometry and Initial Conditions Photogrammetric Program

sp1	-8.0549	-2.1649	Photo	#2
sp2	-9.3388	-1.8709	Photo	#2
sp3	-8.4818	-1.1543	Photo	#2
sp4	-7.2417	-1.4510	Photo	#2
x+06	-4.291	-3.267	Photo	#2
x+12	-0.1129	-4.3138	Photo	#2
x+18	4.4902	-5.5098	Photo	#2
x+24	9.3853	-6.7941	Photo	#2
y+12	-3.7281	1.6400	Photo	#2
y+06	-5.8430	-0.2239	Photo	#2
y-06	-10.8802	-4.6525	Photo	#2
z+06	-8.7003	1.7261	Photo	#2
z+12	-9.2215	6.1414	Photo	#2

#3	-55.005	0.020	0.020 #3-674	
lfc1	4.0397	5.5041	Photo	#3
lfc2	3.3822	5.9104	Photo	#3
lfc3	4.3475	6.0686	Photo	#3
lfc4	5.0157	5.6775	Photo	#3
lfc5	3.9276	4.3961	Photo	#3
lfc6	3.2902	4.8045	Photo	#3
lfc8	4.9122	4.5765	Photo	#3
c1	1.0056	5.0284	Photo	#3
c3	1.3874	5.5909	Photo	#3
c4	2.0284	5.1684	Photo	#3
c5	0.9178	3.8817	Photo	#3
c8	1.9329	4.0447	Photo	#3
a	-12.6827	-3.4459	Photo	#3
b	-12.5170	-5.0742	Photo	#3
d	4.9602	-1.0055	Photo	#3
e	4.8275	-2.3334	Photo	#3
rtc1	-16.0460	0.8673	Photo	#3
rtc2	-16.4107	1.3511	Photo	#3
rtc4	-14.7222	1.1431	Photo	#3
sp1	-16.2537	2.1037	Photo	#3
sp2	-16.6145	2.6419	Photo	#3
sp3	-15.2553	2.9138	Photo	#3
sp4	-14.8698	2.3758	Photo	#3
x+06	-14.5019	0.1988	Photo	#3
x+12	-13.1821	-1.7553	Photo	#3
x+18	-11.6577	-4.0109	Photo	#3
x+24	-9.8755	-6.6632	Photo	#3
y+12	-7.9444	3.5109	Photo	#3
y+06	-11.7075	2.7318	Photo	#3
z+06	-16.1786	5.6897	Photo	#3
xz+12	-16.7422	9.7612	Photo	#3

#4	-55.004	0.020	0.020 #4-623	
lfc1	11.9856	1.2442	Photo	#4
lfc2	12.2511	1.7817	Photo	#4
lfc3	13.6146	1.5487	Photo	#4
lfc4	13.3883	1.0000	Photo	#4
lfc5	11.8238	-0.0178	Photo	#4
c1	7.8991	1.9887	Photo	#4
c2	8.2240	2.4982	Photo	#4
c3	9.5354	2.2570	Photo	#4
c4	9.2529	1.7262	Photo	#4
c5	7.7547	0.7611	Photo	#4
c7	9.3949	1.0326	Photo	#4

NAVAL BIODYNAMICS LABORATORY SOFTWARE DOCUMENTATION

c8	9.0995	0.4975	Photo	#4
a	-10.4645	-0.1838	Photo	#4
b	-10.3155	-1.6816	Photo	#4
c	-11.9078	-9.7659	Photo	#4
d	7.4771	-5.5855	Photo	#4
e	7.3383	-7.0749	Photo	#4
rtc1	-7.8348	3.6102	Photo	#4
rtc3	-6.2303	3.8926	Photo	#4
rtc4	-6.7993	3.4752	Photo	#4
sp1	-7.9426	4.7458	Photo	#4
sp2	-7.3425	5.1556	Photo	#4
sp3	-6.3067	5.0077	Photo	#4
sp4	-6.8889	4.6032	Photo	#4
x+06	-8.8910	3.0027	Photo	#4
x+12	-10.9770	1.4999	Photo	#4
x+18	-13.3023	-0.2410	Photo	#4
x+24	-15.9514	-2.2621	Photo	#4
y+12	-0.4666	3.4284	Photo	#4
y+06	-3.8499	3.8573	Photo	#4
y-06	-10.1517	4.7047	Photo	#4
y-12	-13.1429	5.0840	Photo	#4
z+06	-7.3604	7.7035	Photo	#4
z+12	-7.6641	11.3800	Photo	#4

#5	-55.002	0.020	0.020 #5-591	
lfc1	13.3795	-1.6085	Photo	#5
lfc2	14.7298	-1.2864	Photo	#5
lfc3	15.7318	-2.0111	Photo	#5
lfc4	14.4085	-2.3869	Photo	#5
lfc5	13.2096	-3.0164	Photo	#5
lfc8	14.2222	-3.7791	Photo	#5
c1	10.5775	0.4921	Photo	#5
c2	11.8470	0.8065	Photo	#5
c3	12.7689	0.1301	Photo	#5
c4	11.5012	-0.1853	Photo	#5
c5	10.4317	-0.8291	Photo	#5
c7	12.6007	-1.2216	Photo	#5
c8	11.3409	-1.5308	Photo	#5
a	-2.7736	3.4709	Photo	#5
b	-2.7222	2.0911	Photo	#5
c	-7.6505	-3.8720	Photo	#5
d	5.1662	-6.6614	Photo	#5
e	5.0906	-8.1907	Photo	#5
g	-4.2882	7.4172	Photo	#5
h	-15.3891	8.7627	Photo	#5
i	-15.7543	-4.8527	Photo	#5
rtc1	2.6955	5.8670	Photo	#5
rtc3	4.2374	5.7007	Photo	#5
rtc4	3.1984	5.5125	Photo	#5
sp1	2.6777	6.9694	Photo	#5
sp2	3.7358	7.1549	Photo	#5
sp3	4.2493	6.8127	Photo	#5
sp4	3.1962	6.6312	Photo	#5
x+06	0.2781	5.7630	Photo	#5
x+12	-3.1115	5.1552	Photo	#5
x+18	-6.6368	4.4791	Photo	#5
yx+24	-10.3156	3.7349	Photo	#5
y+12	6.9283	4.0150	Photo	#5
y+06	5.0857	5.2340	Photo	#5

Anthropometry and Initial Conditions Photogrammetric Program

Xy-06	3.9596	7.3648		Photo	#5
y-12	0.5790	8.2080		Photo	#5
z+06	3.4629	9.7016		Photo	#5

#6	-55.005	0.020	0.020	#6-806	
lfc1	2.4619	-7.3557		Photo	#6
lfc2	4.1722	-7.6623		Photo	#6
lfc3	3.6394	-8.6773		Photo	#6
Xlfc4	3.8602	-8.3064		Photo	#6
lfc6	4.1490	-9.1757		Photo	#6
lfc7	3.6160	-10.1749		Photo	#6
lfc8	1.8773	-9.8583		Photo	#6
c1	3.9168	-4.7417		Photo	#6
c2	5.5280	-5.0057		Photo	#6
c3	5.0931	-5.8876		Photo	#6
c4	3.4403	-5.6032		Photo	#6
c7	5.0483	-7.3159		Photo	#6
c8	3.4226	-7.0360		Photo	#6
c	-2.5993	-4.1716		Photo	#6
d	-3.5502	-9.3521		Photo	#6
e	-3.4781	-10.9654		Photo	#6
g	12.5777	3.6942		Photo	#6
h	3.0283	7.6486		Photo	#6
i	-1.7179	-3.7904		Photo	#6
rtc2	11.2539	1.1715		Photo	#6
rtc3	11.0150	0.7755		Photo	#6
rtc4	9.7846	0.9472		Photo	#6
sp1	10.1463	2.5314		Photo	#6
sp2	11.3748	2.3577		Photo	#6
sp3	11.1379	1.9639		Photo	#6
sp4	9.8826	2.1281		Photo	#6
x+06	6.9469	2.1357		Photo	#6
x+12	3.4434	2.5823		Photo	#6
x+18	0.0651	2.9968		Photo	#6
x+24	-3.1824	3.3527		Photo	#6
y+12	8.8903	-1.1057		Photo	#6
y+06	9.7853	0.3410		Photo	#6
y-06	11.2744	2.8317		Photo	#6
y-12	11.9040	3.9156		Photo	#6
z+06	10.8673	5.2170		Photo	#6
z+12	11.1705	9.0396		Photo	#6

Appendix B

GIANT Files

Input Files

GIANT has two input files: Image Data File (IMG.DAT) and Program Options & Input File (OPT.DAT). Examples of Image Data Files were given in Appendix A.

Initial Conditions OPT.DAT File

(Note: Only five cameras were used for this run. Six cameras are normally used.)

```

02111010001009000 11          0.0      0.0
      .0005      .0005      .0005      object space control
#1-580      -57.092
#2-736      -56.988
#3-674      -57.295
#4-623      -57.434
#5-591      -57.292
*****
#1      -0.420      -1.298      0.938      0.1      0.1      0.1
#1 195026.815 -280651.283 41841.376 20000. 20000. 20000.
#2      0.959      -1.266      0.962      0.1      0.1      0.1
#2 3325245.322 -292850.340 -15808.992 20000. 20000. 20000.
#3      1.861      -0.392      0.912      0.1      0.1      0.1
#3 2993522.783 -282517.808 5422.861 20000. 20000. 20000.
#4      1.886      1.124      0.863      0.1      0.1      0.1
#4 2465401.190 -261854.437 -14203.303 20000. 20000. 20000.
#5      1.003      2.043      0.816      0.1      0.1      0.1
#5 2020334.515 -261000.348 -22254.677 20000. 20000. 20000.
*****
a      0.2977      0.0099      -0.0707
b      0.2988      0.0088      -0.1351
c      0.5555      0.0766      -0.3266
d      0.2991      0.7227      -0.1620
e      0.2996      0.7200      -0.2236
g      0.0549      -0.9181      -0.2093
h      0.6597      -1.0184      -0.0603
i      0.8362      -0.6713      -0.7043
rtc1    0.0252      -0.0249      -0.0250
rtc2   -0.0247      -0.0250      -0.0261
rtc3   -0.0252      0.0251      -0.0255
rtc4    0.0253      0.0250      -0.0253
rtc6   -0.0246      -0.0254      -0.0767
rtc7   -0.0246      0.0256      -0.0756
rtc8    0.0254      0.0252      -0.0765
cen1    0.0701      0.6693      0.0204
cen2    0.0197      0.6681      0.0200
cen3    0.0181      0.7182      0.0163
cen4    0.0682      0.7196      0.0166
cen5    0.0706      0.6656      -0.0303

```


Anthropometry and Initial Conditions Photogrammetric Program

cen7	0.0190	0.7157	-0.0337
cen8	0.0688	0.7164	-0.0336
lfc1	0.0653	0.8193	0.0114
lfc2	0.0152	0.8187	0.0111
lfc3	0.0145	0.8687	0.0085
lfc4	0.0646	0.8699	0.0088
lfc5	0.0662	0.8170	-0.0394
lfc6	0.0156	0.8152	-0.0391
lfc8	0.0648	0.8673	-0.0411

Body Anthropometry OPT.DAT File

```

02111000001009000 10
.00025 .00025 .00025
LfEyLfSh -838.200
RtEyLfSh -838.200
LfEyRtSh -838.200
RtEyRtSh -838.200
*****
LfEyLfSh 0.506 -0.451 -0.080 0.01 0.01 0.01
LfEyLfSh 3151911.056 -1059.271 1647.281 10000. 10000. 10000.
RtEyLfSh 0.548 -0.413 -0.078 0.01 0.01 0.01
RtEyLfSh 3150729.283 -1631.101 10108.979 10000. 10000. 10000.
LfEyRtSh 0.515 0.470 -0.068 0.01 0.01 0.01
LfEyRtSh 2223804.999 -13008.431 -13520.960 10000. 10000. 10000.
RtEyRtSh 0.483 0.499 -0.067 0.01 0.01 0.01
RtEyRtSh 2221908.014 -13824.763 -12002.768 10000. 10000. 10000.
*****
r1 0.0325 -0.0468 0.00356
r2 0.0309 -0.0460 -0.02190
r3 0.0309 -0.0241 -0.02180
r4 0.0315 -0.0242 0.00280
r5 0.0523 -0.0460 0.00305
r6 0.0521 -0.0467 -0.02200
r7 0.0526 -0.0232 -0.02160
r8 0.0532 -0.0243 0.00330
c1 -0.03073 -0.00731 0.00178
c2 -0.03073 -0.00698 -0.01870
c3 -0.03073 0.01422 -0.02286
c4 -0.03100 0.01574 0.00254
c5 -0.00813 -0.00757 0.00254
c6 -0.00838 -0.00879 -0.01994
c7 -0.00787 0.01550 -0.02060
c8 -0.00762 0.01641 0.00216
l1 0.03048 0.03300 0.00317
l2 0.03073 0.03380 -0.02020
l3 0.03109 0.05500 -0.02060
l4 0.03020 0.05640 0.00330
l5 0.05385 0.03400 0.00315
l6 0.05260 0.03400 -0.02010
l7 0.05160 0.05550 -0.02060
l8 0.05385 0.05610 0.00315
*****

```

Anthropometry and Initial Conditions Photogrammetric Program

Body Anthropometry OPT.DAT File — Premount Modification

HRV # 0227

00001010001109000 2

0.000250 0.000250 0.000250

LfEyLfSh -889.000 0.250 0.250

RtEyLfSh -889.000 0.250 0.250

LfEyRtSh -889.000 0.250 0.250

RtEyRtSh -889.000 0.250 0.250

LfEyLfSh -0.446 0.003 0.724 0.04 0.04 0.04

LfEyLfSh -30753.786 324055.341 53224.185 20000. 20000. 50000.

RtEyLfSh -0.412 -0.004 0.750 0.04 0.04 0.04

RtEyLfSh -25648.055 365055.966 42450.451 20000. 20000. 50000.

LfEyRtSh 0.310 0.013 0.825 0.04 0.04 0.04

LfEyRtSh 1216.754 -285642.826 -21733.348 20000. 20000. 50000.

RtEyRtSh 0.413 0.022 0.780 0.04 0.04 0.04

RtEyRtSh 902.372 -294739.770 -21416.237 20000. 20000. 50000.

ctp .0000 .0000 .0000

rtp -.0889 .0000 .0635

ltp .0889 .0000 .0635

0
0
0

Head Anthropometry OPT.DAT File

```

02111000001009000 11
.00025 .00025 .00025 object space control -- instrument coordinates
#1-580 -57.092
#2-736 -56.988
#3-674 -57.295
#4-623 -57.434
#5-591 -57.292
#6-806 -57.539
*****
#1 -0.215 -1.296 -0.704 .010 .010 .010
#1 123907.524 212026.467 1140044.621 10000. 10000. 10000.
#2 -0.681 -1.365 0.234 .010 .010 .010
#2 281640.865 -145943.634 1233733.229 10000. 100000. 10000.
#3 -0.881 -0.523 0.734 .010 .010 .010
#3 643038.319 -451500.948 1565717.778 10000. 10000. 10000.
#4 -0.870 0.156 0.750 .010 .010 .010
#4 950102.260 -463437.760-1773742.194 10000. 10000. 10000.
#5 -0.669 0.994 0.337 .010 .010 .010
#5 1375856.349 -263803.624-1350102.512 10000. 10000. 10000.
#6 -0.217 0.995 -0.568 .010 .010 .010
#6 1633732.172 160415.301-1105627.125 10000. 10000. 10000.
*****
mrc1 .02950 -.04813 .00457
mrc2 .02950 -.04813 -.02032
mrc3 .02950 -.02375 -.02032
mrc4 .02950 -.02375 .00457
mrc5 .05490 -.04813 .00457
mrc6 .05490 -.04813 -.02032
mrc7 .05490 -.02375 -.02032
mrc8 .05490 -.02375 .00457
mcc1 -.03200 -.00838 .00457
mcc2 -.03200 -.00838 -.02172
mcc3 -.03200 .01753 -.02172
mcc4 -.03200 .01753 .00457
mcc5 -.00635 -.00838 .00457
mcc6 -.00635 -.00838 -.02172
mcc7 -.00635 .01753 -.02172
mcc8 -.00635 .01753 .00457
mlc1 .02980 .03152 .00508
mlc2 .02980 .03152 -.02045
mlc3 .02980 .05705 -.02045
mlc4 .02980 .05705 .00508
mlc5 .05480 .03152 .00508
mlc6 .05476 .03152 -.02045
mlc7 .05480 .05705 -.02045
mlc8 .05480 .05705 .00508
*****

```

Anthropometry and Initial Conditions Photogrammetric Program

Head Anthropometry OPT.DAT File — Premount Modification

HRV # 0222

00001010001109000 1

0.000250 0.000250 0.000250

AP CAM -1820.09

LAT CAM - 889.00

A/Phrv45	1.068	0.577	1.160	0.10	0.10	0.10
A/Phrv45	211014.306	-491537.856	84935.941	10000.	10000.	10000.
A/Pprism	0.523	0.234	1.618	0.10	0.10	0.10
A/Pprism	15412.372	-224814.291	-4329.419	10000.	10000.	10000.
LAThrv45	-0.500	0.259	0.672	0.10	0.10	0.10
LAThrv45	190143.916	392138.153	-165243.147	10000.	10000.	10000.
LATprism	-0.645	0.172	0.415	0.10	0.10	0.10
LATprism	32255.040	682534.993	-20135.417	10000.	10000.	10000.

c1	-0.0469	0.0508	0.0194	0.0005	0.0005	0.0005	0
c2	-0.2347	0.0508	0.0972	0.0005	0.0005	0.0005	0
c3	-0.2347	0.2540	0.0972	0.0005	0.0005	0.0005	0
c4	-0.0469	0.2540	0.0194	0.0005	0.0005	0.0005	0
c5	0.0237	0.2540	0.0573	0.0005	0.0005	0.0005	0
c6	0.0194	0.0508	0.0469	0.0005	0.0005	0.0005	0
c7	0.0972	0.0508	0.2347	0.0005	0.0005	0.0005	0
c8	0.0972	0.2540	0.2347	0.0005	0.0005	0.0005	0
c9	0.0503	0.1524	0.2541				0
c10	-0.0825	0.1524	0.1991				0
c11	-0.2152	0.1524	0.1441				0
c12	-0.0825	0.0508	0.1991				0
c13	-0.0825	0.2540	0.1991				0

Site Survey OPT.DAT File

```

02111010001009000 11      0.0      0.0
0.0005      0.0005      0.0005      object space control
#1-580      -57.092
#2-736      -56.988
#3-674      -57.295
#4-623      -57.434
#5-591      -57.292
#6-806      -57.539
*****
#1      -0.420      -1.298      0.938      0.1      0.1      0.1
#1 195026.815 -280651.283 41841.376 20000. 20000. 20000.
#2      0.959      -1.266      0.962      0.1      0.1      0.1
#2 3325245.322 -292850.340 -15808.992 20000. 20000. 20000.
#3      1.861      -0.392      0.912      0.1      0.1      0.1
#3 2993522.783 -282517.808 5422.861 20000. 20000. 20000.
#4      1.886      1.124      0.863      0.1      0.1      0.1
#4 2465401.190 -261854.437 -14203.303 20000. 20000. 20000.
#5      1.003      2.043      0.816      0.1      0.1      0.1
#5 2020334.515 -261000.348 -22254.677 20000. 20000. 20000.
#6      -0.361      2.092      0.787      0.1      0.1      0.1
#6 1583448.831 -222547.057 -1108.903 20000. 20000. 20000.
*****
sp1      0.0254      -0.0254      0.0254
sp2      -0.0254      -0.0254      0.0254
sp3      -0.0254      0.0254      0.0254
sp4      0.0254      0.0254      0.0254
rtc1      0.0254      -0.0254      -0.0254
rtc2      -0.0254      -0.0254      -0.0254
rtc3      -0.0254      0.0254      -0.0254
rtc4      0.0254      0.0254      -0.0254
rtc5      0.0254      -0.0254      -0.0762
rtc6      -0.0254      -0.0254      -0.0762
rtc7      -0.0254      0.0254      -0.0762
rtc8      0.0254      0.0254      -0.0762
z+12      0.0000      0.0000      0.3048
z+06      0.0000      0.0000      0.1524
y+12      0.0000      0.3048      0.0000
y+06      0.0000      0.1524      0.0000
y-06      0.0000      -0.1524      0.0000
y-12      0.0000      -0.3048      0.0000
x+24      0.6048      0.0000      0.0000
x+18      0.4572      0.0000      0.0000
x+12      0.3048      0.0000      0.0000
x+06      0.1524      0.0000      0.0000
*****
#2      .600      -1.500      .600      0.2      0.2      0.2
#2 710920.170 272650.444 90718.956 500. 500. 500.
#3      1.500      0.000      .600      0.2      0.2      0.2
#3 492355.502 664443.019 395816.778 500. 500. 500.
#4      1.500      .600      .600      0.2      0.2      0.2
#4 -101342.721 713806.049 1002814.067 500. 500. 500.
#5      .600      2.700      .600      0.2      0.2      0.2
#5 -612956.739 410812.461 1601544.882 500. 500. 500.
#6      -.300      2.700      .600      0.2      0.2      0.2
#6 -663405.275 -82306.154-1755645.212 500. 500. 500.

```

Anthropometry and Initial Conditions Photogrammetric Program

Output Files

Initial Conditions Output File

NBDL GIANT: 08:47 05/19/92 Page 1
35mm Still Camera System For Initial Conditions Of RUN # = LX6422

Object Space Reference System is Rectangular

Rotation angles are Terrestrial Object-to-Photo

Complete Triangulation process is requested

Error Propagation is requested

[Variance/Covariance output]

Unit Variance will be based on completely free camera parameters

All Image Residuals will be listed

Triangulated Object Coordinates will not be saved

Adjusted Camera Station Parameters will be saved

NBDL GIANT: 08:47 05/19/92 Page 2
35mm Still Camera System For Initial Conditions Of RUN # = LX6422

E R R O R W A R N I N G S

POINTS NOT PHOTOGRAPHED

rtc7

PASS POINTS APPEARING ON 1 PHOTO

*	cen1	*	cen3	*	cen5	*	cen7
*	lfc1	*	lfc2	*	lfc4	*	lfc6

NBDL GIANT: 08:47 05/19/92 Page 3
35mm Still Camera System For Initial Conditions Of RUN # = LX6422

C A M E R A S T A T I O N S C O R R E C T I O N S

----- P O S I T I O N ----- ----- A T T I T U D E -----

NAVAL BIODYNAMICS LABORATORY SOFTWARE DOCUMENTATION

	X	Y	Z		Azim.	Elev.	Swing
Iteration 1							
#1	0.0045	0.0320	-0.0175 m.		-0.053781	-0.016545	-0.030237
#2	0.0110	0.0194	-0.0004 m.		-0.034333	-0.014277	-0.023851
#3	0.0075	0.0197	0.0144 m.		0.018638	-0.051629	0.033912
#4	-0.0065	0.0106	-0.0028 m.		-0.005101	0.012266	-0.021293
#5	0.0080	-0.0048	-0.0066 m.		0.030224	-0.018579	0.015213

Provisional Weighted Sum of Squares = 634521.

Iteration 2							
#1	-0.0006	-0.0076	0.0035 m.		0.001399	-0.000585	-0.001253
#2	-0.0114	-0.0087	0.0020 m.		-0.007168	0.000838	0.000339
#3	0.0010	-0.0012	-0.0006 m.		-0.000375	-0.000185	0.000226
#4	0.0013	-0.0012	-0.0006 m.		0.000628	0.000346	0.000065
#5	0.0004	0.0011	0.0014 m.		-0.000296	-0.000139	0.000113

Provisional Weighted Sum of Squares = 1176.94

Iteration 3							
#1	0.0000	0.0000	0.0000 m.		0.000001	-0.000010	-0.000014
#2	0.0004	0.0003	0.0000 m.		0.000244	-0.000077	0.000011
#3	0.0000	0.0000	0.0000 m.		-0.000008	0.000037	-0.000031
#4	0.0000	0.0000	0.0000 m.		0.000019	0.000017	-0.000012
#5	0.0000	0.0000	0.0000 m.		-0.000003	0.000003	-0.000004

Provisional Weighted Sum of Squares = 274.075

Iteration 4							
#1	0.0000	0.0000	0.0000 m.		0.000000	0.000000	0.000000
#2	0.0000	0.0000	0.0000 m.		-0.000004	0.000006	-0.000002
#3	0.0000	0.0000	0.0000 m.		0.000000	-0.000001	0.000001
#4	0.0000	0.0000	0.0000 m.		0.000000	-0.000001	0.000001
#5	0.0000	0.0000	0.0000 m.		0.000000	0.000000	0.000000

Provisional Weighted Sum of Squares = 274.024

Anthropometry and Initial Conditions Photogrammetric Program

NBDL GIANT: 08:47 05/19/92

Page 4

35mm Still Camera System For Initial Conditions Of

RUN # = LX6422

T R I A N G U L A T E D I M A G E P O I N T S R E S I D U A L S
(in micrometers)

a *0*	#1	#2	#3	#4
	19	0	-39	22
	40	-30	-50	27
b *0*	#1	#2	#3	#4
	2	-6	-19	16
	9	-19	-22	21
c *0*	#2	#1	#4	#5
	30	-59	-6	-28
	-34	4	8	62
rtc1 *0*	#2	#3	#1	#4
	8	-22	14	-2
	-13	-19	-4	24
rtc2 *0*	#1	#2	#3	#4
	-3	-12	14	-38
	4	46	-9	-57
rtc3 *0*	#1	#2	#3	#4
	-19	41	17	1
	5	8	-29	-8
rtc4 *0*	#2	#1	#3	#4
	-2	-23	5	-21
	16	15	24	4
rtc5	#2	#3	#1	#4
	-4	-5	12	19
	1	0	-2	2
rtc6 *0*	#1	#2	#3	
	0	13	26	
	-54	-25	110	
cen2 *0*	#3	#1	#4	#5
	9	-40	0	-26
	0	-6	-17	6
cen6	#1	#3		
	0	1		
	-3	3		
lfc7	#1	#4	#5	
	32	-6	18	
	-17	33	-16	
m_r1	#2	#3	#4	#1
	3	-9	10	2
	0	-12	5	6

NAVAL BIODYNAMICS LABORATORY SOFTWARE DOCUMENTATION

NBDL GIANT: 08:47 05/19/92

Page 5

35mm Still Camera System For Initial Conditions Of

RUN # = LX6422

T R I A N G U L A T E D I M A G E P O I N T S R E S I D U A L S
(in micrometers)

m_r4	#2	#1	#3	#4	
	16	0	-3	6	
	-7	-18	16	8	
m_t1	#1	#2	#3	#4	#5
	25	-3	1	9	11
	-11	11	-16	21	-7
m_t4	#3	#2	#1	#4	#5
	21	-12	-7	-29	4
	32	-25	16	-13	-9
m_b1	#3	#1	#2	#4	#5
	7	19	-14	-13	10
	25	10	-11	-3	-22
m_b4	#3	#2	#1	#4	#5
	28	-10	10	0	-2
	15	-19	-25	18	5
mtar01	#1	#3	#2		
	0	-3	-11		
	12	-32	20		
mtar03	#3	#1	#2		
	12	12	-10		
	16	-12	-6		
mtar06	#3	#2	#1	#4	
	5	-23	4	-11	
	-10	26	7	-23	
mtar07	#3	#1	#2	#4	#5
	5	1	-5	-12	12
	18	21	-20	-26	8
mtar11	#1	#2	#3	#4	#5
	-3	-4	-6	0	-1
	1	39	-45	14	-8
rtc8 *0*	#2	#3			
	0	18			
	25	4			
mtar09	#3	#4	#2		
	-16	6	6		
	-11	-7	19		
d *0*	#4	#5	#3		
	37	-39	-4		
	-11	-38	14		

Anthropometry and Initial Conditions Photogrammetric Program

NBDL GIANT: 08:47 05/19/92

Page 6

35mm Still Camera System For Initial Conditions Of

RUN # = LX6422

TRIANGULATED IMAGE POINTS RESIDUALS
(in micrometers)

e *0*	#4	#3	#5
	29	13	-22
	-13	13	-45
f	#3	#4	
	2	2	
	-20	18	
cen1 *0*	#4	#5	#3
	5	-6	-13
	15	9	-8
cen3 *0*	#3	#4	#5
	-6	3	-12
	-18	-22	3
cen4 *0*	#3	#4	#5
	-23	-22	4
	10	-12	13
cen5 *0*	#4	#5	#3
	17	-11	0
	-29	18	-5
cen8 *0*	#3	#5	#4
	-4	0	5
	-6	-14	18
lfc1 *0*	#3	#5	#4
	-17	18	0
	0	6	23
lfc2 *0*	#4	#3	#5
	-2	6	13
	-7	13	-15
lfc3 *0*	#4	#5	#3
	-26	10	20
	-24	18	-14
lfc4 *0*	#5	#4	#3
	16	9	-7
	15	3	-13
lfc5 *0*	#5	#3	#4
	31	-7	-11
	31	-33	-12
lfc6 *0*	#3		
	1		
	30		

NAVAL BIODYNAMICS LABORATORY SOFTWARE DOCUMENTATION

NBDL GIANT: 08:47 05/19/92

Page 7

35mm Still Camera System For Initial Conditions Of

RUN # = LX6422

TRIANGULATED IMAGE POINTS RESIDUALS
(in micrometers)

lfc8 *0*	#4	#5	#3
	-8	20	-11
	-2	3	33
m_11	#4	#5	#3
	-4	1	3
	9	-7	-3
m_14	#5	#3	#4
	-5	0	-4
	-25	3	22
mtar08	#4	#5	#3
	7	-7	-6
	2	-3	1
cen7 *0*	#5	#4	
	-28	14	
	18	-10	
g *0*	#5		
	-59		
	-23		
h *0*	#5		
	47		
	-30		
i *0*	#5		
	18		
	47		

Weighted Sum of Squares (Camera) =	10.6
Weighted Sum of Squares (Object) =	23.0
Weighted Sum of Squares (Plates) =	198.9

Weighted Sum of Squares (Total) =	232.6
Degrees of Freedom..... =	219

a posteriori Variance of Unit Weight =	1.062
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Anthropometry and Initial Conditions Photogrammetric Program

NBDL GIANT: 08:47 05/19/92

Page 8

35mm Still Camera System For Initial Conditions Of

RUN # = LX6422

T R I A N G U L A T E D C A M E R A S T A T I O N S (Terrestrial->Ph)

Ident	Position/Attitude	Covariance Matrix
#1	X = -0.4161 m.	+6.464E-06 -1.127E-06 +1.874E-06
	Y = -1.2737 m.	-1.127E-06 +3.629E-06 -1.916E-06
	Z = 0.9240 m.	+1.874E-06 -1.916E-06 +1.211E-05
	Azim. = 23 23 7.7343	+2.215E-06 -8.075E-07 -9.951E-07
	Elev. =- 28 28 22.2050	-8.075E-07 +2.215E-06 -9.951E-07
	Swing = 04 30 20.1043	-9.951E-07 -9.951E-07 +1.899E-06
#2	X = 0.9589 m.	+8.445E-05 +1.558E-05 -2.980E-05
	Y = -1.2551 m.	+1.558E-05 +3.261E-05 +3.255E-05
	Z = 0.9635 m.	-2.980E-05 +3.255E-05 +7.439E-05
	Azim. = 335 20 18.8974	+2.659E-05 +5.336E-06 -5.121E-06
	Elev. =- 30 44 10.5319	+5.336E-06 +2.659E-05 -5.121E-06
	Swing =- 02 22 27.9251	-5.121E-06 -5.121E-06 +7.303E-06
#3	X = 1.8695 m.	+5.670E-06 +4.617E-06 -1.719E-07
	Y = -0.3735 m.	+4.617E-06 +8.153E-06 +2.155E-06
	Z = 0.9258 m.	-1.719E-07 +2.155E-06 +7.046E-06
	Azim. = 297 15 51.8284	+1.768E-06 -6.505E-07 +5.537E-08
	Elev. =- 29 08 19.2178	-6.505E-07 +1.768E-06 +5.537E-08
	Swing =- 00 32 43.9160	+5.537E-08 +5.537E-08 +4.103E-06
#4	X = 1.8808 m.	+4.551E-06 -3.575E-06 -1.163E-06
	Y = 1.1334 m.	-3.575E-06 +8.362E-06 -2.180E-06
	Z = 0.8596 m.	-1.163E-06 -2.180E-06 +7.209E-06
	Azim. = 247 02 10.9444	+1.828E-06 +3.716E-07 -6.554E-08
	Elev. =- 26 46 59.3300	+3.716E-07 +1.828E-06 -6.554E-08
	Swing =- 02 15 41.0295	-6.554E-08 -6.554E-08 +5.368E-06
#5	X = 1.0114 m.	+6.005E-06 +1.816E-06 +1.160E-06
	Y = 2.0392 m.	+1.816E-06 +1.593E-06 -2.155E-07
	Z = 0.8108 m.	+1.160E-06 -2.155E-07 +5.105E-06
	Azim. = 203 43 47.2399	+8.511E-07 -1.164E-07 +4.012E-07
	Elev. =- 24 52 19.6241	-1.164E-07 +8.511E-07 +4.012E-07
	Swing =- 01 09 39.0473	+4.012E-07 +4.012E-07 +1.824E-06

S U M M A R Y S T A T I S T I C S F O R C A M E R A S T A T I O N S

RMS For Standard Deviations

Count = 5	X = 0.0046 m.	Azim. = 00 08 51.9034
	Y = 0.0033 m.	Elev. = 00 10 24.0679
	Z = 0.0046 m.	Swing = 00 06 57.6248

NAVAL BIODYNAMICS LABORATORY SOFTWARE DOCUMENTATION

NBDL GIANT: 08:47 05/19/92

Page 9

35mm Still Camera System For Initial Conditions Of

RUN # = LX6422

T R I A N G U L A T E D O B J E C T P O I N T S

Ident		Position (meters)	Covariance Matrix				Std Dev (m)
a	*0*	X =	0.2974	+1.740E-07	+6.278E-09	+1.107E-08	0.0004
		Y =	0.0104	+6.278E-09	+1.653E-07	-1.666E-08	0.0004
		Z =	-0.0706	+1.107E-08	-1.666E-08	+1.631E-07	0.0004
b	*0*	X =	0.2989	+1.677E-07	+4.085E-09	+1.403E-08	0.0004
		Y =	0.0091	+4.085E-09	+1.622E-07	-1.839E-08	0.0004
		Z =	-0.1350	+1.403E-08	-1.839E-08	+1.634E-07	0.0004
c	*0*	X =	0.5555	+1.869E-07	+7.241E-09	+1.116E-08	0.0004
		Y =	0.0768	+7.241E-09	+1.947E-07	+2.325E-09	0.0004
		Z =	-0.3269	+1.116E-08	+2.325E-09	+1.948E-07	0.0004
d	*0*	X =	0.2987	+1.884E-07	+8.421E-09	+3.027E-08	0.0004
		Y =	0.7222	+8.421E-09	+1.711E-07	+1.450E-08	0.0004
		Z =	-0.1616	+3.027E-08	+1.450E-08	+1.751E-07	0.0004
e	*0*	X =	0.2992	+1.894E-07	+8.250E-09	+3.095E-08	0.0004
		Y =	0.7193	+8.250E-09	+1.702E-07	+1.494E-08	0.0004
		Z =	-0.2231	+3.095E-08	+1.494E-08	+1.784E-07	0.0004
f		X =	-1.3294	+4.304E-05	-4.595E-06	+1.208E-05	0.0066
		Y =	0.7979	-4.595E-06	+4.974E-06	-1.245E-06	0.0022
		Z =	-0.1228	+1.208E-05	-1.245E-06	+7.801E-06	0.0028
g	*0*	X =	0.0545	+2.488E-07	+4.645E-09	+2.198E-09	0.0005
		Y =	-0.9180	+4.645E-09	+2.627E-07	+3.735E-09	0.0005
		Z =	-0.2092	+2.198E-09	+3.735E-09	+2.526E-07	0.0005
h	*0*	X =	0.6600	+2.454E-07	+2.079E-09	+8.145E-10	0.0005
		Y =	-1.0185	+2.079E-09	+2.637E-07	+5.551E-09	0.0005
		Z =	-0.0600	+8.145E-10	+5.551E-09	+2.457E-07	0.0005
i	*0*	X =	0.8364	+2.462E-07	+1.675E-10	+1.937E-09	0.0005
		Y =	-0.6712	+1.675E-10	+2.603E-07	+9.387E-09	0.0005
		Z =	-0.7046	+1.937E-09	+9.387E-09	+2.485E-07	0.0005
cen1	*0*	X =	0.0702	+1.965E-07	+1.487E-08	+2.825E-08	0.0004
		Y =	0.6695	+1.487E-08	+1.697E-07	+1.042E-08	0.0004
		Z =	0.0202	+2.825E-08	+1.042E-08	+1.635E-07	0.0004
cen2	*0*	X =	0.0197	+1.825E-07	+1.510E-08	+2.446E-08	0.0004
		Y =	0.6682	+1.510E-08	+1.669E-07	+4.339E-09	0.0004
		Z =	0.0202	+2.446E-08	+4.339E-09	+1.556E-07	0.0004
cen3	*0*	X =	0.0179	+1.989E-07	+1.525E-08	+2.814E-08	0.0004
		Y =	0.7183	+1.525E-08	+1.694E-07	+1.058E-08	0.0004
		Z =	0.0166	+2.814E-08	+1.058E-08	+1.653E-07	0.0004
cen4	*0*	X =	0.0683	+1.959E-07	+1.498E-08	+2.846E-08	0.0004
		Y =	0.7200	+1.498E-08	+1.683E-07	+1.073E-08	0.0004
		Z =	0.0165	+2.846E-08	+1.073E-08	+1.634E-07	0.0004

Anthropometry and Initial Conditions Photogrammetric Program

NBDL GIANT: 08:47 05/19/92

Page 10

35mm Still Camera System For Initial Conditions Of

RUN # = LX6422

TRIANGULATED OBJECT POINTS

Ident		Position (meters)	Covariance Matrix				Std Dev (m)
cen5	*0*	X =	0.0704	+1.964E-07	+1.444E-08	+2.914E-08	0.0004
		Y =	0.6656	+1.444E-08	+1.699E-07	+1.124E-08	0.0004
		Z =	-0.0302	+2.914E-08	+1.124E-08	+1.661E-07	0.0004
cen6		X =	0.0204	+1.276E-06	-4.484E-07	+4.119E-07	0.0011
		Y =	0.6633	-4.484E-07	+1.674E-06	-6.546E-07	0.0013
		Z =	-0.0311	+4.119E-07	-6.546E-07	+1.154E-06	0.0011
cen7	*0*	X =	0.0187	+2.118E-07	+2.906E-08	+2.738E-08	0.0005
		Y =	0.7158	+2.906E-08	+1.926E-07	+2.005E-08	0.0004
		Z =	-0.0338	+2.738E-08	+2.005E-08	+1.859E-07	0.0004
cen8	*0*	X =	0.0689	+1.958E-07	+1.451E-08	+2.941E-08	0.0004
		Y =	0.7163	+1.451E-08	+1.687E-07	+1.151E-08	0.0004
		Z =	-0.0336	+2.941E-08	+1.151E-08	+1.660E-07	0.0004
lfc1	*0*	X =	0.0657	+1.949E-07	+1.510E-08	+2.895E-08	0.0004
		Y =	0.8194	+1.510E-08	+1.658E-07	+1.135E-08	0.0004
		Z =	0.0111	+2.895E-08	+1.135E-08	+1.634E-07	0.0004
lfc2	*0*	X =	0.0153	+1.983E-07	+1.518E-08	+2.871E-08	0.0004
		Y =	0.8185	+1.518E-08	+1.675E-07	+1.128E-08	0.0004
		Z =	0.0112	+2.871E-08	+1.128E-08	+1.651E-07	0.0004
lfc3	*0*	X =	0.0144	+1.982E-07	+1.501E-08	+2.910E-08	0.0004
		Y =	0.8688	+1.501E-08	+1.668E-07	+1.162E-08	0.0004
		Z =	0.0087	+2.910E-08	+1.162E-08	+1.652E-07	0.0004
lfc4	*0*	X =	0.0649	+1.946E-07	+1.507E-08	+2.928E-08	0.0004
		Y =	0.8698	+1.507E-08	+1.647E-07	+1.164E-08	0.0004
		Z =	0.0087	+2.928E-08	+1.164E-08	+1.637E-07	0.0004
lfc5	*0*	X =	0.0665	+1.949E-07	+1.454E-08	+3.007E-08	0.0004
		Y =	0.8172	+1.454E-08	+1.665E-07	+1.198E-08	0.0004
		Z =	-0.0394	+3.007E-08	+1.198E-08	+1.662E-07	0.0004
lfc6	*0*	X =	0.0157	+2.481E-07	-1.635E-08	+1.336E-08	0.0005
		Y =	0.8151	-1.635E-08	+2.329E-07	-8.751E-09	0.0005
		Z =	-0.0394	+1.336E-08	-8.751E-09	+2.291E-07	0.0005
lfc7		X =	0.0151	+1.081E-06	+5.146E-07	+4.363E-07	0.0010
		Y =	0.8667	+5.146E-07	+7.990E-07	+2.980E-07	0.0009
		Z =	-0.0435	+4.363E-07	+2.980E-07	+6.476E-07	0.0008
lfc8	*0*	X =	0.0652	+1.947E-07	+1.448E-08	+3.047E-08	0.0004
		Y =	0.8673	+1.448E-08	+1.656E-07	+1.212E-08	0.0004
		Z =	-0.0414	+3.047E-08	+1.212E-08	+1.665E-07	0.0004
m_b1		X =	0.4426	+4.856E-07	+8.406E-08	+9.592E-08	0.0007
		Y =	0.3770	+8.406E-08	+6.617E-07	+8.215E-09	0.0008
		Z =	0.0610	+9.592E-08	+8.215E-09	+3.880E-07	0.0006

NAVAL BIODYNAMICS LABORATORY SOFTWARE DOCUMENTATION

NBDL GIANT: 08:47 05/19/92

Page 11

35mm Still Camera System For Initial Conditions Of

RUN # = LX6422

T R I A N G U L A T E D O B J E C T P O I N T S

Ident		Position (meters)	Covariance Matrix				Std Dev (m)
m_b4	X =	0.4432	+4.992E-07	+8.936E-08	+1.046E-07		0.0007
	Y =	0.4015	+8.936E-08	+6.729E-07	+1.740E-08		0.0008
	Z =	0.0603	+1.046E-07	+1.740E-08	+3.979E-07		0.0006
m_l1	X =	0.3785	+8.510E-07	+1.769E-07	+2.904E-07		0.0009
	Y =	0.4429	+1.769E-07	+7.128E-07	+1.356E-07		0.0008
	Z =	0.0587	+2.904E-07	+1.356E-07	+5.603E-07		0.0007
m_l4	X =	0.3812	+8.431E-07	+1.713E-07	+2.877E-07		0.0009
	Y =	0.4672	+1.713E-07	+7.102E-07	+1.338E-07		0.0008
	Z =	0.0586	+2.877E-07	+1.338E-07	+5.608E-07		0.0007
m_r1	X =	0.3750	+5.278E-07	+2.259E-08	+1.052E-07		0.0007
	Y =	0.3092	+2.259E-08	+6.204E-07	-7.672E-08		0.0008
	Z =	0.0614	+1.052E-07	-7.672E-08	+4.199E-07		0.0006
m_r4	X =	0.3758	+5.416E-07	+2.388E-08	+1.134E-07		0.0007
	Y =	0.3328	+2.388E-08	+6.331E-07	-7.194E-08		0.0008
	Z =	0.0615	+1.134E-07	-7.194E-08	+4.289E-07		0.0007
m_t1	X =	0.4255	+4.964E-07	+8.312E-08	+8.654E-08		0.0007
	Y =	0.3801	+8.312E-08	+6.831E-07	+5.775E-09		0.0008
	Z =	0.1119	+8.654E-08	+5.775E-09	+3.749E-07		0.0006
m_t4	X =	0.4261	+5.068E-07	+8.763E-08	+9.454E-08		0.0007
	Y =	0.4031	+8.763E-08	+6.929E-07	+1.373E-08		0.0008
	Z =	0.1102	+9.454E-08	+1.373E-08	+3.838E-07		0.0006
rtc1	*0* X =	0.0249	+1.628E-07	-2.363E-09	+1.401E-08		0.0004
	0 Y =	-0.0244	-2.363E-09	+1.626E-07	-2.030E-08		0.0004
	0 Z =	-0.0249	+1.401E-08	-2.030E-08	+1.584E-07		0.0004
rtc2	*0* X =	-0.0249	+1.652E-07	-3.041E-09	+1.378E-08		0.0004
	0 Y =	-0.0251	-3.041E-09	+1.657E-07	-2.079E-08		0.0004
	0 Z =	-0.0261	+1.378E-08	-2.079E-08	+1.616E-07		0.0004
rtc3	*0* X =	-0.0255	+1.653E-07	-2.973E-09	+1.354E-08		0.0004
	0 Y =	0.0245	-2.973E-09	+1.660E-07	-2.070E-08		0.0004
	0 Z =	-0.0252	+1.354E-08	-2.070E-08	+1.604E-07		0.0004
rtc4	*0* X =	0.0256	+1.617E-07	-2.712E-09	+1.443E-08		0.0004
	0 Y =	0.0248	-2.712E-09	+1.627E-07	-2.035E-08		0.0004
	0 Z =	-0.0259	+1.443E-08	-2.035E-08	+1.564E-07		0.0004
rtc5	X =	0.0266	+4.157E-07	-3.722E-08	+9.723E-08		0.0006
	Y =	-0.0255	-3.722E-08	+4.379E-07	-1.485E-07		0.0007
	Z =	-0.0747	+9.723E-08	-1.485E-07	+4.311E-07		0.0007
rtc6	*0* X =	-0.0243	+1.716E-07	-9.050E-09	+1.208E-08		0.0004
	0 Y =	-0.0254	-9.050E-09	+1.803E-07	-2.972E-08		0.0004
	0 Z =	-0.0768	+1.208E-08	-2.972E-08	+1.762E-07		0.0004

Anthropometry and Initial Conditions Photogrammetric Program

NBDL GIANT: 08:47 05/19/92

Page 12

35mm Still Camera System For Initial Conditions Of

RUN # = LX6422

T R I A N G U L A T E D O B J E C T P O I N T S

Ident	Position (meters)	Covariance Matrix				Std Dev (m)
rtc8	X =	0.0254	+2.146E-07	-2.335E-08	+2.792E-08	0.0005
	0 Y =	0.0248	-2.335E-08	+1.945E-07	-2.030E-08	0.0004
	Z =	-0.0768	+2.792E-08	-2.030E-08	+1.982E-07	0.0004
mtar01	X =	0.3598	+5.951E-07	-1.162E-07	+1.476E-07	0.0008
	Y =	0.3080	-1.162E-07	+9.873E-07	-3.053E-07	0.0010
	Z =	0.0551	+1.476E-07	-3.053E-07	+6.109E-07	0.0008
mtar03	X =	0.4105	+6.704E-07	-1.140E-07	+1.567E-07	0.0008
	Y =	0.3786	-1.140E-07	+1.149E-06	-2.941E-07	0.0011
	Z =	0.1055	+1.567E-07	-2.941E-07	+6.479E-07	0.0008
mtar06	X =	0.3653	+5.319E-07	+2.035E-08	+1.078E-07	0.0007
	Y =	0.3201	+2.035E-08	+6.211E-07	-7.385E-08	0.0008
	Z =	0.0672	+1.078E-07	-7.385E-08	+4.183E-07	0.0006
mtar07	X =	0.4159	+4.996E-07	+8.401E-08	+9.004E-08	0.0007
	Y =	0.3921	+8.401E-08	+6.815E-07	+9.648E-09	0.0008
	Z =	0.1170	+9.004E-08	+9.648E-09	+3.740E-07	0.0006
mtar08	X =	0.3688	+8.512E-07	+1.766E-07	+2.885E-07	0.0009
	Y =	0.4555	+1.766E-07	+7.038E-07	+1.331E-07	0.0008
	Z =	0.0642	+2.885E-07	+1.331E-07	+5.532E-07	0.0007
mtar09	X =	0.4217	+8.977E-07	-6.048E-08	+2.875E-07	0.0009
	Y =	0.3911	-6.048E-08	+7.958E-07	-7.179E-08	0.0009
	Z =	0.0995	+2.875E-07	-7.179E-08	+6.158E-07	0.0008
mtar11	X =	0.4324	+4.891E-07	+8.507E-08	+9.887E-08	0.0007
	Y =	0.3887	+8.507E-08	+6.600E-07	+1.215E-08	0.0008
	Z =	0.0667	+9.887E-08	+1.215E-08	+3.863E-07	0.0006

S U M M A R Y S T A T I S T I C S F O R O B J E C T P O I N T S

RMS For Standard Deviations

Count = 19	X =	0.0017 meters
Count = 19	Y =	0.0010 meters
Count = 19	Z =	0.0010 meters

NBDL GIANT: 08:47 05/19/92

Page 13

35mm Still Camera System For Initial Conditions Of

RUN # = LX6422

C O R R E C T I O N S A P P L I E D T O O B J E C T C O N T R O L

lfc1	X =	0.0004 m	rtc1	X =	-0.0003 m
	Y =	0.0001 m		Y =	0.0005 m
	Z =	-0.0003 m		Z =	0.0001 m
cen1	X =	0.0001 m	lfc2	X =	0.0001 m
	Y =	0.0002 m		Y =	-0.0002 m
	Z =	-0.0002 m		Z =	0.0001 m

NAVAL BIODYNAMICS LABORATORY SOFTWARE DOCUMENTATION

rtc2	X =	-0.0002 m	cen2	X =	0.0000 m
	Y =	-0.0001 m		Y =	0.0001 m
	Z =	0.0000 m		Z =	0.0002 m
lfc3	X =	-0.0001 m	rtc3	X =	-0.0003 m
	Y =	0.0001 m		Y =	-0.0006 m
	Z =	0.0002 m		Z =	0.0003 m
cen3	X =	-0.0002 m	lfc4	X =	0.0003 m
	Y =	0.0001 m		Y =	-0.0001 m
	Z =	0.0003 m		Z =	-0.0001 m
rtc4	X =	0.0003 m	cen4	X =	0.0001 m
	Y =	-0.0002 m		Y =	0.0004 m
	Z =	-0.0006 m		Z =	-0.0001 m
lfc5	X =	0.0003 m	cen5	X =	-0.0002 m
	Y =	0.0002 m		Y =	0.0000 m
	Z =	0.0000 m		Z =	0.0001 m
lfc6	X =	0.0001 m	rtc6	X =	0.0003 m
	Y =	-0.0001 m		Y =	0.0000 m
	Z =	-0.0003 m		Z =	-0.0001 m
cen7	X =	-0.0003 m	lfc8	X =	0.0004 m
	Y =	0.0001 m		Y =	0.0000 m
	Z =	-0.0001 m		Z =	-0.0003 m
rtc8	X =	0.0000 m	cen8	X =	0.0001 m
	Y =	-0.0004 m		Y =	-0.0001 m
	Z =	-0.0003 m		Z =	0.0000 m
a	X =	-0.0003 m	b	X =	0.0001 m
	Y =	0.0005 m		Y =	0.0003 m
	Z =	0.0001 m		Z =	0.0001 m
c	X =	0.0000 m	d	X =	-0.0004 m
	Y =	0.0002 m		Y =	-0.0005 m
	Z =	-0.0003 m		Z =	0.0004 m
e	X =	-0.0004 m	g	X =	-0.0004 m
	Y =	-0.0007 m		Y =	0.0001 m
	Z =	0.0005 m		Z =	0.0001 m

NBDL GIANT: 08:47 05/19/92

Page 14

35mm Still Camera System For Initial Conditions Of

RUN # = LX6422

C O R R E C T I O N S A P P L I E D T O O B J E C T C O N T R O L

h	X =	0.0003 m	i	X =	0.0002 m
	Y =	-0.0001 m		Y =	0.0001 m
	Z =	0.0003 m		Z =	-0.0003 m

X	Number of Components =	28	RMS =	0.0003 meters
Y	Number of Components =	28	RMS =	0.0003 meters
Z	Number of Components =	28	RMS =	0.0003 meters

Initial Conditions Variables Output File

MOUT

mrc1

-0.8648E-01	0.4629E+00	0.1269E+01
0.9093E-06	-0.6112E-07	0.2316E-06
-0.6112E-07	0.7139E-06	-0.1220E-06
0.2316E-06	-0.1220E-06	0.5972E-06

mrc2

-0.1076E+00	0.4632E+00	0.1279E+01
0.9149E-06	-0.6451E-07	0.2245E-06
-0.6451E-07	0.7217E-06	-0.1228E-06
0.2245E-06	-0.1228E-06	0.5902E-06

mrc3

-0.1077E+00	0.4877E+00	0.1278E+01
0.1180E-05	-0.1490E-06	0.8757E-07
-0.1490E-06	0.6389E-05	-0.2296E-05
0.8757E-07	-0.2296E-05	0.1990E-05

mrc4

-0.8646E-01	0.4860E+00	0.1267E+01
0.1124E-05	-0.4158E-06	0.3245E-06
-0.4158E-06	0.1481E-05	-0.4862E-06
0.3245E-06	-0.4862E-06	0.9088E-06

mrc5

-0.9708E-01	0.4618E+00	0.1247E+01
0.9150E-06	-0.6718E-07	0.2429E-06
-0.6718E-07	0.7240E-06	-0.1321E-06
0.2429E-06	-0.1321E-06	0.6160E-06

mrc6

-0.1192E+00	0.4632E+00	0.1257E+01
0.1112E-05	-0.3978E-06	0.3177E-06
-0.3978E-06	0.1463E-05	-0.4859E-06
0.3177E-06	-0.4859E-06	0.9078E-06

mrc8

-0.9644E-01	0.4851E+00	0.1247E+01
0.1772E-05	-0.3121E-06	0.6742E-06
-0.3121E-06	0.8256E-06	-0.1980E-06
0.6742E-06	-0.1980E-06	0.9296E-06

mcc1

-0.5581E-01	0.5008E+00	0.1320E+01
0.4963E-06	-0.8871E-08	0.7922E-07
-0.8871E-08	0.5400E-06	0.1556E-07
0.7922E-07	0.1556E-07	0.3653E-06

mcc2

-0.7629E-01	0.5012E+00	0.1331E+01
0.4924E-06	-0.7829E-08	0.7519E-07
-0.7829E-08	0.5429E-06	0.1690E-07
0.7519E-07	0.1690E-07	0.3583E-06

mcc3

-0.7654E-01	0.5244E+00	0.1330E+01
0.4914E-06	-0.1173E-07	0.7500E-07
-0.1173E-07	0.5382E-06	0.2014E-07
0.7500E-07	0.2014E-07	0.3569E-06

mcc4

-0.5577E-01	0.5243E+00	0.1319E+01
0.4955E-06	-0.1291E-07	0.7911E-07
-0.1291E-07	0.5353E-06	0.1879E-07

NAVAL BIODYNAMICS LABORATORY SOFTWARE DOCUMENTATION

```

0.7911E-07  0.1879E-07  0.3640E-06
mcc5
-0.6706E-01  0.5015E+00  0.1298E+01
0.6681E-06  0.5306E-07  0.1510E-06
0.5306E-07  0.6056E-06 -0.7331E-08
0.1510E-06 -0.7331E-08  0.4541E-06
mcc6
-0.8913E-01  0.5006E+00  0.1309E+01
0.1128E-05 -0.4259E-06  0.2983E-06
-0.4259E-06  0.1499E-05 -0.4519E-06
0.2983E-06 -0.4519E-06  0.8629E-06
mcc7
-0.8884E-01  0.5244E+00  0.1310E+01
0.3775E-05  0.2246E-05  0.1791E-05
0.2246E-05  0.2502E-05  0.1348E-05
0.1791E-05  0.1348E-05  0.1757E-05
mcc8
-0.6609E-01  0.5244E+00  0.1298E+01
0.5921E-06 -0.4204E-07  0.1162E-06
-0.4204E-07  0.5729E-06  0.4435E-07
0.1162E-06  0.4435E-07  0.4262E-06
mlc1
-0.8271E-01  0.5402E+00  0.1266E+01
0.8253E-06  0.1786E-06  0.2136E-06
0.1786E-06  0.1012E-05  0.3492E-06
0.2136E-06  0.3492E-06  0.7516E-06
mlc2
-0.1051E+00  0.5392E+00  0.1277E+01
0.3976E-05  0.2308E-05  0.1999E-05
0.2308E-05  0.2505E-05  0.1455E-05
0.1999E-05  0.1455E-05  0.1948E-05
mlc3
-0.1036E+00  0.5633E+00  0.1278E+01
0.1519E-05  0.2323E-06  0.5673E-06
0.2323E-06  0.7246E-06  0.1619E-06
0.5673E-06  0.1619E-06  0.8159E-06
mlc4
-0.8294E-01  0.5628E+00  0.1266E+01
0.7063E-06  0.1768E-08  0.1617E-06
0.1768E-08  0.6098E-06  0.1124E-06
0.1617E-06  0.1124E-06  0.5203E-06
mlc5
-0.9514E-01  0.5393E+00  0.1245E+01
0.1533E-05  0.2380E-06  0.6140E-06
0.2380E-06  0.7394E-06  0.1739E-06
0.6140E-06  0.1739E-06  0.8753E-06
mlc7
-0.1154E+00  0.5644E+00  0.1256E+01
0.8123E-06  0.1706E-06  0.2090E-06
0.1706E-06  0.9951E-06  0.3556E-06
0.2090E-06  0.3556E-06  0.7489E-06
mlc8
-0.9365E-01  0.5631E+00  0.1245E+01
0.7120E-06  0.6653E-08  0.1706E-06
0.6653E-08  0.6166E-06  0.1209E-06
0.1706E-06  0.1209E-06  0.5373E-06
EOFEOF
NECK
nrcl

```

Anthropometry and Initial Conditions Photogrammetric Program

```

-0.4155E+00  0.4776E+00  0.1298E+01
 0.4786E-06 -0.2392E-07  0.5230E-07
-0.2392E-07  0.8547E-06  0.3863E-07
 0.5230E-07  0.3863E-07  0.4152E-06
nrc2
-0.4169E+00  0.4769E+00  0.1274E+01
 0.1217E-05 -0.5895E-06  0.3408E-06
-0.5895E-06  0.1903E-05 -0.6128E-06
 0.3408E-06 -0.6128E-06  0.9826E-06
nrc4
-0.4156E+00  0.5013E+00  0.1297E+01
 0.8176E-06 -0.4946E-07  0.1461E-06
-0.4946E-07  0.1036E-05 -0.1327E-06
 0.1461E-06 -0.1327E-06  0.6077E-06
nrc5
-0.3915E+00  0.4771E+00  0.1297E+01
 0.4772E-06 -0.2757E-07  0.5198E-07
-0.2757E-07  0.8471E-06  0.3636E-07
 0.5198E-07  0.3636E-07  0.4142E-06
nrc6
-0.3926E+00  0.4756E+00  0.1273E+01
 0.8046E-06 -0.5173E-07  0.1487E-06
-0.5173E-07  0.1023E-05 -0.1439E-06
 0.1487E-06 -0.1439E-06  0.6149E-06
nrc7
-0.3917E+00  0.4999E+00  0.1271E+01
 0.1577E-05 -0.1488E-06  0.4309E-06
-0.1488E-06  0.1111E-05 -0.5962E-07
 0.4309E-06 -0.5962E-07  0.8985E-06
nrc8
-0.3909E+00  0.5006E+00  0.1296E+01
 0.4722E-06 -0.2556E-07  0.5084E-07
-0.2556E-07  0.8426E-06  0.4789E-07
 0.5084E-07  0.4789E-07  0.4130E-06
ncc1
-0.4759E+00  0.5038E+00  0.1298E+01
 0.4683E-06 -0.9856E-08  0.5362E-07
-0.9856E-08  0.8679E-06  0.5707E-07
 0.5362E-07  0.5707E-07  0.4195E-06
ncc2
-0.4755E+00  0.5010E+00  0.1274E+01
 0.1398E-05 -0.1409E-05  0.5925E-06
-0.1409E-05  0.7676E-05 -0.2836E-05
 0.5925E-06 -0.2836E-05  0.2213E-05
ncc3
-0.4757E+00  0.5315E+00  0.1274E+01
 0.6341E-06  0.6131E-07 -0.1935E-08
 0.6131E-07  0.3477E-05  0.6309E-06
-0.1935E-08  0.6309E-06  0.9106E-06
ncc4
-0.4754E+00  0.5278E+00  0.1296E+01
 0.5392E-06 -0.1542E-06  0.3631E-07
-0.1542E-06  0.1196E-05  0.4205E-07
 0.3631E-07  0.4205E-07  0.4985E-06
ncc5
-0.4520E+00  0.5033E+00  0.1299E+01
 0.4839E-06  0.5372E-07  0.4304E-07
 0.5372E-07  0.1350E-05  0.1379E-06
 0.4304E-07  0.1379E-06  0.5007E-06

```

NAVAL BIODYNAMICS LABORATORY SOFTWARE DOCUMENTATION

```

ncc6
-0.4518E+00  0.4986E+00  0.1275E+01
  0.1357E-05 -0.1291E-05  0.5438E-06
-0.1291E-05  0.7511E-05 -0.2769E-05
  0.5438E-06 -0.2769E-05  0.2177E-05
ncc8
-0.4515E+00  0.5268E+00  0.1297E+01
  0.5791E-06  0.2720E-06  0.8541E-07
  0.2720E-06  0.1927E-05  0.3870E-06
  0.8541E-07  0.3870E-06  0.6536E-06
nlc1
-0.4154E+00  0.5561E+00  0.1294E+01
  0.8009E-06  0.3342E-06  0.2306E-06
  0.3342E-06  0.1309E-05  0.4913E-06
  0.2306E-06  0.4913E-06  0.7726E-06
nlc3
-0.4166E+00  0.5774E+00  0.1268E+01
  0.7915E-06  0.3223E-06  0.2375E-06
  0.3223E-06  0.1274E-05  0.5088E-06
  0.2375E-06  0.5088E-06  0.8008E-06
nlc4
-0.4155E+00  0.5776E+00  0.1292E+01
  0.6030E-06  0.1010E-06  0.1146E-06
  0.1010E-06  0.9140E-06  0.2391E-06
  0.1146E-06  0.2391E-06  0.5483E-06
nlc5
-0.3912E+00  0.5542E+00  0.1293E+01
  0.4724E-06  0.6826E-07  0.6348E-07
  0.6826E-07  0.8051E-06  0.1057E-06
  0.6348E-07  0.1057E-06  0.4162E-06
nlc6
-0.3909E+00  0.5528E+00  0.1270E+01
  0.1766E-05  0.3526E-06  0.5265E-06
  0.3526E-06  0.1101E-05  0.1662E-06
  0.5265E-06  0.1662E-06  0.9276E-06
nlc7
-0.3922E+00  0.5773E+00  0.1267E+01
  0.6131E-06  0.9385E-07  0.1188E-06
  0.9385E-07  0.9022E-06  0.2410E-06
  0.1188E-06  0.2410E-06  0.5648E-06
nlc8
-0.3915E+00  0.5776E+00  0.1291E+01
  0.4680E-06  0.6728E-07  0.6385E-07
  0.6728E-07  0.7895E-06  0.1145E-06
  0.6385E-07  0.1145E-06  0.4159E-06
EOFEOF
EOFEOF

```

Anthropometry and Initial Conditions Photogrammetric Program

Head Anthropometry Output File

NBDL GIANT: 09:17 10/13/92 Page 1
35mm Still Camera System for Head Anthropometry of HRV # = 0253

Object Space Reference System is Rectangular
Rotation angles are Terrestrial Object-to-Photo

Complete Triangulation process is requested

Error Propagation is requested

[Variance/Covariance output]

Unit Variance will be based on completely free camera parameters

All Image Residuals will be listed

Triangulated Object Coordinates will be saved

Adjusted Camera Station Parameters will be saved

NBDL GIANT: 09:17 10/13/92 Page 2
35mm Still Camera System for Head Anthropometry of HRV # = 0253

ERROR WARNINGS

POINTS NOT PHOTOGRAPHED

mrc7 mlc6

PASS POINTS APPEARING ON 1 PHOTO

	j		k	*	a	*	j
*	rtc5		lfc7	*	b		rtc7
*	cen1	*	lfc1	*	lfc3	*	lfc7

NBDL GIANT: 09:17 10/13/92 Page 3
35mm Still Camera System for Head Anthropometry of HRV # = 0253

CAMERA STATIONS CORRECTIONS

----- POSITION ----- ATTITUDE -----

X Y Z Azim. Elev. Swing

Iteration 1

NAVAL BIODYNAMICS LABORATORY SOFTWARE DOCUMENTATION

#1	-0.0037	0.0023	-0.0120 m.	-0.004066	0.008765	0.015261
#2	-0.0128	0.0011	-0.0112 m.	-0.009281	0.007311	0.009436
#3	-0.0116	0.0032	-0.0095 m.	-0.011792	0.001311	-0.000853
#4	-0.0070	0.0022	-0.0092 m.	-0.009982	-0.003119	-0.007529
#5	-0.0002	0.0021	-0.0046 m.	-0.002934	-0.005424	-0.013494
#6	0.0098	0.0038	-0.0001 m.	0.006825	0.000337	-0.009053

Provisional Weighted Sum of Squares = 210.083

NBDL GIANT: 09:17 10/13/92

Page 4

35mm Still Camera System for Head Anthropometry of

HRV # = 0253

TRIANGULATED IMAGE POINTS RESIDUALS
(in micrometers)

a	#1	#3	#4		
	-2	5	-5		
	2	0	-1		
rtc1	#2	#1	#3	#4	#6
	-3	6	-24	9	-10
	-24	23	10	25	-32
rtc2	#2	#3	#1	#4	#6
	-2	-47	-42	10	-57
	8	8	28	-17	-24
rtc3	#1	#2	#3	#4	#6
	-1	-18	19	24	-11
	-17	-5	3	-11	34
rtc4	#2	#1	#3	#4	#6
	13	-9	21	-12	1
	9	-22	4	1	13
rtc5	#1	#3	#4		
	-3	-5	3		
	13	-62	50		
rtc6	#2	#3	#1		
	-48	50	29		
	-19	29	-5		
ear1-r	#2	#3	#4	#5	#1
	67	-32	-27	54	-10
	-15	-27	17	10	20
ear2-r	#2	#3	#1	#4	#5
	52	-18	-29	-19	13
	6	5	0	-17	12
ear3-r	#2	#1	#3	#4	
	40	-23	-19	-1	
	-7	3	-10	19	
ear4-r	#2	#3	#1	#4	
	31	-11	-11	3	

Anthropometry and Initial Conditions Photogrammetric Program

	-18	-3	-7	30
mrc1 *0*	#3	#1	#2	#4
	2	24	16	-52
	-40	11	2	-46
mrc2 *0*	#2	#3	#4	#1
	75	-5	-22	93
	37	-3	-14	23

NBDL GIANT: 09:17 10/13/92

Page 5

35mm Still Camera System for Head Anthropometry of

HRV # = 0253

TRIANGULATED IMAGE POINTS RESIDUALS
(in micrometers)

mrc3 *0*	#1	#2				
	37	1				
	-14	-3				
mrc4 *0*	#1					
	95					
	-17					
mrc5 *0*	#1	#3	#2	#4		
	8	-1	-8	-17		
	15	-51	32	-56		
mrc6 *0*	#3	#1	#2			
	55	24	-3			
	14	3	-24			
mcc1 *0*	#2	#3	#4	#5	#1	#6
	-13	0	-17	5	-13	47
	25	45	21	23	20	-41
mcc2 *0*	#1	#3	#2	#4	#5	#6
	-40	18	-28	44	71	113
	4	45	76	85	45	-25
mcc3 *0*	#3	#1	#4	#5	#2	#6
	26	-64	67	44	-64	-51
	50	23	67	1	-14	28
mcc4 *0*	#1	#3	#2	#4	#5	#6
	-17	86	5	39	-10	8
	-62	75	-4	21	-16	-9
mcc5 *0*	#3	#2	#1	#4	#5	
	-40	-58	-49	-18	32	
	17	-20	-20	-10	-2	
b	#4	#2	#3	#5		
	-10	43	-33	25		
	23	-35	-4	14		

NAVAL BIODYNAMICS LABORATORY SOFTWARE DOCUMENTATION

c	#3	#2	#5	
	65	-59	-39	
	-16	24	-9	
d	#4	#2	#5	
	52	-34	-41	
	-7	9	2	
rtc8	#4	#3	#2	#6
	28	31	-71	-50
	0	19	-32	15

NBDL GIANT: 09:17 10/13/92

35mm Still Camera System for Head Anthropometry of

Page 6
HRV # = 0253

TRIANGULATED IMAGE POINTS RESIDUALS
(in micrometers)

cen1	#2	#4	#5	#3
	31	-13	18	-16
	-18	13	7	-4
cen3	#4	#5	#2	#6
	27	-20	21	23
	-35	-16	0	28
cen4	#5	#2	#4	#6
	10	47	0	25
	-27	-7	-43	43
cen5	#2	#4	#5	
	2	-1	-2	
	-9	26	-14	
cen8	#5	#2	#4	#6
	-20	47	-10	18
	8	-19	32	-16
lfc5	#3	#4	#5	#2
	-4	-19	11	14
	-22	3	-5	30
lfc6	#2	#3		
	3	1		
	-15	15		
ron	#4	#2	#3	
	7	13	-7	
	17	-26	6	
mrc8 *0*	#4	#3	#2	
	-7	0	-48	
	-23	6	97	
* g	#3	#4		
	1	0		

Anthropometry and Initial Conditions Photogrammetric Program

	28	-28		
* h	#4	#3		
	-1	0		
	1	-1		
lfc1	#5	#4	#3	
	6	-11	11	
	23	-16	-12	
lfc2	#5	#3	#4	#6
	-16	5	12	7
	11	-30	17	-2

NBDL GIANT: 09:17 10/13/92

Page 7

35mm Still Camera System for Head Anthropometry of

HRV # = 0253

TRIANGULATED IMAGE POINTS RESIDUALS
(in micrometers)

lfc3	#5	#4	#3	
	12	-26	24	
	28	-15	-23	
lfc4	#4	#5	#3	#6
	-49	24	14	-9
	6	-3	16	-8
lfc8	#4	#5	#6	#3
	-58	-9	-19	1
	42	36	-60	41
lon	#5	#4	#3	
	1	-10	5	
	-13	11	1	
ear1-1	#5	#6	#4	#3
	24	-47	2	-64
	9	-18	13	1
ear2-1	#5	#4	#6	#3
	-1	23	-17	-40
	10	16	-9	-13
ear3-1	#5	#4	#3	#6
	17	3	-56	-41
	0	30	-1	-22
ear4-1	#5	#4	#3	#6
	20	13	-52	-34
	5	7	-3	-5
mcc6 *0*	#3			
	-6			
	38			

NAVAL BIODYNAMICS LABORATORY SOFTWARE DOCUMENTATION

mcc8 *0*	#5	#4	#3	#6
	-4	20	61	35
	-14	-12	20	-13
mlc3 *0*	#4	#3	#5	#6
	12	-6	-9	-8
	-40	-46	8	0
mlc4 *0*	#5	#4	#3	#6
	-41	-1	35	-5
	-27	-62	-62	2
mlc5 *0*	#5	#4	#3	
	-73	-48	-40	
	45	-58	-2	

NBDL GIANT: 09:17 10/13/92

35mm Still Camera System for Head Anthropometry of

Page 8
HRV # = 0253

TRIANGULATED IMAGE POINTS RESIDUALS
(in micrometers)

mlc8 *0*	#4	#3	#5	#6
	-2	6	-63	15
	-70	-29	-72	61
f	#4	#5		
	-2	0		
	1	0		
cen2	#5	#6	#4	
	-11	16	33	
	-21	40	-49	
mcc7 *0*	#5	#4		
	74	54		
	-30	52		
mlc1 *0*	#4	#6	#5	
	-39	67	-58	
	-9	6	0	
mlc7 *0*	#4	#5	#6	
	-43	-58	-21	
	0	-32	5	
mlc2 *0*	#5			
	-17			
	11			

Weighted Sum of Squares (Camera) =	13.4
Weighted Sum of Squares (Object) =	5.9
Weighted Sum of Squares (Plates) =	138.1
Weighted Sum of Squares (Total) =	157.5

Anthropometry and Initial Conditions Photogrammetric Program

Degrees of Freedom..... = 281

a posteriori Variance of Unit Weight = 0.561

NBDL GIANT: 09:17 10/13/92

35mm Still Camera System for Head Anthropometry of

Page 9
HRV # = 0253

TRIANGULATED CAMERA STATIONS (Terrestrial->Ph)

Ident	Position/Attitude	Covariance Matrix
#1	X = -0.2187 m.	+2.893E-05 -5.079E-07 +3.698E-06
	Y = -1.2937 m.	-5.079E-07 +1.430E-05 -5.242E-06
	Z = -0.7160 m.	+3.698E-06 -5.242E-06 +2.392E-05
	Azim. = 12 56 44.6550	+1.448E-05 -2.413E-06 -4.987E-06
	Elev. = 21 48 39.6688	-2.413E-06 +1.448E-05 -4.987E-06
	Swing = 114 40 31.2480	-4.987E-06 -4.987E-06 +1.477E-05
#2	X = -0.6938 m.	+1.718E-05 -9.827E-07 -7.527E-07
	Y = -1.3639 m.	-9.827E-07 +1.625E-05 +5.055E-06
	Z = 0.2228 m.	-7.527E-07 +5.055E-06 +1.695E-05
	Azim. = 28 46 12.0780	+7.090E-06 +1.332E-06 +1.180E-06
	Elev. =- 14 33 15.9342	+1.332E-06 +7.090E-06 +1.180E-06
	Swing = 124 05 54.9347	+1.180E-06 +1.180E-06 +9.408E-06
#3	X = -0.8926 m.	+9.775E-06 -1.612E-07 +2.053E-07
	Y = -0.5198 m.	-1.612E-07 +9.656E-06 +4.694E-07
	Z = 0.7245 m.	+2.053E-07 +4.694E-07 +8.215E-06
	Azim. = 64 58 22.8413	+5.695E-06 +3.802E-07 -2.040E-07
	Elev. =- 44 39 22.8442	+3.802E-07 +5.695E-06 -2.040E-07
	Swing = 157 11 4.8682	-2.040E-07 -2.040E-07 +8.996E-06
#4	X = -0.8770 m.	+7.769E-06 -3.785E-08 +3.781E-07
	Y = 0.1582 m.	-3.785E-08 +8.131E-06 -3.584E-07
	Z = 0.7408 m.	+3.781E-07 -3.584E-07 +7.453E-06
	Azim. = 95 06 10.2226	+5.611E-06 +2.523E-07 -8.249E-08
	Elev. =- 45 59 37.3703	+2.523E-07 +5.611E-06 -8.249E-08
	Swing =-177 52 29.6638	-8.249E-08 -8.249E-08 +9.655E-06
#5	X = -0.6692 m.	+1.176E-05 +9.495E-07 +8.579E-07
	Y = 0.9961 m.	+9.495E-07 +1.332E-05 -2.766E-06
	Z = 0.3324 m.	+8.579E-07 -2.766E-06 +1.163E-05
	Azim. = 137 54 42.4899	+8.145E-06 -7.442E-07 -5.724E-07
	Elev. =- 26 20 27.0130	-7.442E-07 +8.145E-06 -5.724E-07
	Swing =-135 38 8.4042	-5.724E-07 -5.724E-07 +1.055E-05
#6	X = -0.2072 m.	+9.331E-06 +7.847E-08 -1.787E-06
	Y = 0.9988 m.	+7.847E-08 +6.603E-06 -4.572E-07
	Z = -0.5681 m.	-1.787E-06 -4.572E-07 +1.008E-05
	Azim. = 164 01 58.1799	+6.987E-06 -1.267E-06 -1.007E-06
	Elev. = 16 05 1.2088	-1.267E-06 +6.987E-06 -1.007E-06
	Swing =-111 34 39.0138	-1.007E-06 -1.007E-06 +7.405E-06

NAVAL BIODYNAMICS LABORATORY SOFTWARE DOCUMENTATION

SUMMARY STATISTICS FOR CAMERA STATIONS

RMS For Standard Deviations

	X =	0.0038 m.	Azim. =	00 09 43.4565
Count =	Y =	0.0034 m.	Elev. =	00 11 26.0755
6	Z =	0.0036 m.	Swing =	00 10 56.5213

NBDL GIANT: 09:17 10/13/92 Page 10
 35mm Still Camera System for Head Anthropometry of HRV # = 0253

TRIANGULATED OBJECT POINTS

Ident	Position (meters)	Covariance Matrix	Std Dev (m)
a	X = 0.0324	+3.124E-06 -3.583E-07 -7.127E-07	0.0018
	Y = -0.0593	-3.583E-07 +2.895E-06 +1.427E-07	0.0017
	Z = -0.6096	-7.127E-07 +1.427E-07 +2.597E-06	0.0016
b	X = 0.0433	+2.916E-06 -7.169E-08 -7.855E-07	0.0017
	Y = 0.0940	-7.169E-08 +2.714E-06 -4.694E-08	0.0016
	Z = -0.6061	-7.855E-07 -4.694E-08 +2.745E-06	0.0017
c	X = 0.3055	+3.274E-06 +2.198E-07 -8.627E-07	0.0018
	Y = -0.0671	+2.198E-07 +2.632E-06 -3.183E-07	0.0016
	Z = -0.4791	-8.627E-07 -3.183E-07 +2.870E-06	0.0017
d	X = 0.3069	+3.358E-06 -1.059E-07 -1.023E-06	0.0018
	Y = 0.0869	-1.059E-07 +2.528E-06 +4.636E-08	0.0016
	Z = -0.4758	-1.023E-06 +4.636E-08 +2.962E-06	0.0017
f	X = 0.3498	+5.384E-06 -1.095E-06 -2.368E-06	0.0023
	Y = 0.2866	-1.095E-06 +2.267E-06 +7.869E-07	0.0015
	Z = -0.2119	-2.368E-06 +7.869E-07 +3.278E-06	0.0018
lon	X = -0.0109	+8.230E-07 -1.097E-07 -4.178E-07	0.0009
	Y = 0.0409	-1.097E-07 +4.692E-07 +7.710E-08	0.0007
	Z = -0.0856	-4.178E-07 +7.710E-08 +6.973E-07	0.0008
ron	X = -0.0134	+1.067E-06 +2.586E-07 -6.071E-07	0.0010
	Y = -0.0256	+2.586E-07 +5.706E-07 -2.152E-07	0.0008
	Z = -0.0856	-6.071E-07 -2.152E-07 +9.157E-07	0.0010
cen1	X = 0.1108	+2.326E-06 -1.259E-08 -6.995E-07	0.0015
	Y = 0.1857	-1.259E-08 +2.020E-06 -1.671E-08	0.0014
	Z = -0.4690	-6.995E-07 -1.671E-08 +2.171E-06	0.0015
cen2	X = 0.1308	+2.350E-06 -3.573E-07 -4.329E-07	0.0015
	Y = 0.1897	-3.573E-07 +2.701E-06 +1.774E-07	0.0016
	Z = -0.5119	-4.329E-07 +1.774E-07 +1.986E-06	0.0014
cen3	X = 0.1318	+2.302E-06 -1.874E-07 -4.092E-07	0.0015
	Y = 0.2405	-1.874E-07 +2.565E-06 +7.776E-08	0.0016
	Z = -0.5091	-4.092E-07 +7.776E-08 +2.025E-06	0.0014
	X = 0.1110	+2.000E-06 -1.568E-07 -3.724E-07	0.0014

Anthropometry and Initial Conditions Photogrammetric Program

cen4	Y =	0.2367	-1.568E-07	+2.259E-06	+3.259E-08	0.0015
	Z =	-0.4646	-3.724E-07	+3.259E-08	+1.779E-06	0.0013
cen5	X =	0.1558	+2.555E-06	-1.753E-07	-8.167E-07	0.0016
	Y =	0.1834	-1.753E-07	+2.159E-06	+1.560E-07	0.0015
	Z =	-0.4458	-8.167E-07	+1.560E-07	+2.351E-06	0.0015
cen8	X =	0.1566	+1.978E-06	-1.953E-07	-3.173E-07	0.0014
	Y =	0.2344	-1.953E-07	+2.136E-06	+1.159E-08	0.0015
	Z =	-0.4425	-3.173E-07	+1.159E-08	+1.696E-06	0.0013

NBDL GIANT: 09:17 10/13/92 Page 11
 35mm Still Camera System for Head Anthropometry of HRV # = 0253

T R I A N G U L A T E D O B J E C T P O I N T S

Ident	Position (meters)	Covariance Matrix	Std Dev (m)
lfc1	X = 0.1102	+3.170E-06 -7.730E-08 -1.314E-06	0.0018
	Y = 0.3391	-7.730E-08 +2.378E-06 +1.202E-07	0.0015
	Z = -0.4580	-1.314E-06 +1.202E-07 +3.284E-06	0.0018
lfc2	X = 0.1312	+2.573E-06 -1.361E-07 -5.076E-07	0.0016
	Y = 0.3420	-1.361E-07 +2.635E-06 +5.898E-08	0.0016
	Z = -0.5027	-5.076E-07 +5.898E-08 +2.368E-06	0.0015
lfc3	X = 0.1325	+3.793E-06 -4.265E-08 -1.579E-06	0.0019
	Y = 0.3909	-4.265E-08 +2.833E-06 +1.151E-07	0.0017
	Z = -0.5017	-1.579E-06 +1.151E-07 +4.006E-06	0.0020
lfc4	X = 0.1102	+2.433E-06 -7.554E-08 -5.062E-07	0.0016
	Y = 0.3892	-7.554E-08 +2.449E-06 -3.214E-08	0.0016
	Z = -0.4549	-5.062E-07 -3.214E-08 +2.329E-06	0.0015
lfc5	X = 0.1557	+2.750E-06 +7.287E-08 -8.866E-07	0.0017
	Y = 0.3375	+7.287E-08 +2.267E-06 -4.266E-08	0.0015
	Z = -0.4361	-8.866E-07 -4.266E-08 +2.649E-06	0.0016
lfc6	X = 0.1766	+8.240E-06 +6.098E-06 -5.662E-06	0.0029
	Y = 0.3385	+6.098E-06 +1.049E-05 -6.343E-06	0.0032
	Z = -0.4782	-5.662E-06 -6.343E-06 +8.561E-06	0.0029
lfc8	X = 0.1551	+2.412E-06 -1.240E-07 -4.319E-07	0.0016
	Y = 0.3872	-1.240E-07 +2.305E-06 -5.033E-08	0.0015
	Z = -0.4330	-4.319E-07 -5.033E-08 +2.215E-06	0.0015
mcc1	X = -0.0320	+3.044E-08 -8.260E-11 -8.990E-10	0.0002
	0 Y = -0.0084	-8.260E-11 +3.151E-08 -1.829E-10	0.0002
	Z = 0.0047	-8.990E-10 -1.829E-10 +3.023E-08	0.0002
mcc2	X = -0.0320	+3.044E-08 -9.430E-11 -9.290E-10	0.0002
	0 Y = -0.0085	-9.430E-11 +3.157E-08 -1.729E-10	0.0002
	Z = -0.0214	-9.290E-10 -1.729E-10 +3.030E-08	0.0002
mcc3	X = -0.0319	+3.040E-08 -1.180E-10 -9.309E-10	0.0002
	0 Y = 0.0174	-1.180E-10 +3.157E-08 -1.993E-10	0.0002
	Z = -0.0216	-9.309E-10 -1.993E-10 +3.029E-08	0.0002

NAVAL BIODYNAMICS LABORATORY SOFTWARE DOCUMENTATION

mcc4	*0*	X =	-0.0320	+3.040E-08	-1.048E-10	-8.932E-10	0.0002
		Y =	0.0174	-1.048E-10	+3.150E-08	-2.313E-10	0.0002
		Z =	0.0046	-8.932E-10	-2.313E-10	+3.022E-08	0.0002
mcc5	*0*	X =	-0.0064	+3.155E-08	+4.584E-11	-1.148E-09	0.0002
		Y =	-0.0083	+4.584E-11	+3.181E-08	+3.130E-10	0.0002
		Z =	0.0047	-1.148E-09	+3.130E-10	+3.097E-08	0.0002
mcc6	*0*	X =	-0.0063	+3.436E-08	+3.521E-10	-5.350E-10	0.0002
		Y =	-0.0084	+3.521E-10	+3.396E-08	-3.236E-10	0.0002
		Z =	-0.0217	-5.350E-10	-3.236E-10	+3.419E-08	0.0002

NBDL GIANT: 09:17 10/13/92

Page 12

35mm Still Camera System for Head Anthropometry of

HRV # = 0253

TRIANGULATED OBJECT POINTS

Ident		Position (meters)	Covariance Matrix				Std Dev (m)
mcc7	*0*	X =	-0.0064	+3.345E-08	-6.711E-10	-8.623E-10	0.0002
		Y =	0.0174	-6.711E-10	+3.312E-08	+4.343E-10	0.0002
		Z =	-0.0216	-8.623E-10	+4.343E-10	+3.301E-08	0.0002
mcc8	*0*	X =	-0.0064	+3.158E-08	-4.633E-10	-1.032E-09	0.0002
		Y =	0.0175	-4.633E-10	+3.177E-08	-4.414E-10	0.0002
		Z =	0.0046	-1.032E-09	-4.414E-10	+3.117E-08	0.0002
mlc1	*0*	X =	0.0298	+3.224E-08	-8.427E-10	-6.180E-10	0.0002
		Y =	0.0316	-8.427E-10	+3.270E-08	-2.143E-10	0.0002
		Z =	0.0051	-6.180E-10	-2.143E-10	+3.187E-08	0.0002
mlc2	*0*	X =	0.0298	+3.412E-08	-5.846E-10	-2.080E-10	0.0002
		Y =	0.0315	-5.846E-10	+3.449E-08	+3.164E-10	0.0002
		Z =	-0.0205	-2.080E-10	+3.164E-10	+3.377E-08	0.0002
mlc3	*0*	X =	0.0298	+3.176E-08	-4.666E-10	-9.084E-10	0.0002
		Y =	0.0571	-4.666E-10	+3.193E-08	-4.660E-10	0.0002
		Z =	-0.0205	-9.084E-10	-4.660E-10	+3.136E-08	0.0002
mlc4	*0*	X =	0.0297	+3.175E-08	-4.734E-10	-9.252E-10	0.0002
		Y =	0.0570	-4.734E-10	+3.185E-08	-5.009E-10	0.0002
		Z =	0.0049	-9.252E-10	-5.009E-10	+3.126E-08	0.0002
mlc5	*0*	X =	0.0548	+3.311E-08	-3.030E-10	-1.195E-09	0.0002
		Y =	0.0316	-3.030E-10	+3.230E-08	+7.522E-11	0.0002
		Z =	0.0050	-1.195E-09	+7.522E-11	+3.230E-08	0.0002
mlc7	*0*	X =	0.0548	+3.239E-08	-7.849E-10	-5.438E-10	0.0002
		Y =	0.0571	-7.849E-10	+3.279E-08	-2.320E-10	0.0002
		Z =	-0.0205	-5.438E-10	-2.320E-10	+3.204E-08	0.0002
mlc8	*0*	X =	0.0548	+3.191E-08	-4.740E-10	-8.788E-10	0.0002
		Y =	0.0571	-4.740E-10	+3.195E-08	-4.772E-10	0.0002
		Z =	0.0050	-8.788E-10	-4.772E-10	+3.140E-08	0.0002
mrc1	*0*	X =	0.0295	+3.247E-08	+5.335E-10	-1.008E-09	0.0002
		Y =	-0.0481	+5.335E-10	+3.230E-08	+1.241E-10	0.0002

Anthropometry and Initial Conditions Photogrammetric Program

	Z =	0.0045	-1.008E-09	+1.241E-10	+3.206E-08	0.0002	
mrc2	*0*	X =	0.0296	+3.248E-08	+5.214E-10	-9.715E-10	0.0002
		Y =	-0.0481	+5.214E-10	+3.237E-08	+9.889E-11	0.0002
		Z =	-0.0204	-9.715E-10	+9.889E-11	+3.214E-08	0.0002
mrc3	*0*	X =	0.0295	+3.352E-08	+4.497E-10	+1.193E-11	0.0002
		Y =	-0.0237	+4.497E-10	+3.461E-08	+2.461E-10	0.0002
		Z =	-0.0203	+1.193E-11	+2.461E-10	+3.352E-08	0.0002
mrc4	*0*	X =	0.0295	+3.415E-08	+1.281E-10	+7.458E-11	0.0002
		Y =	-0.0237	+1.281E-10	+3.480E-08	+3.775E-10	0.0002
		Z =	0.0045	+7.458E-11	+3.775E-10	+3.433E-08	0.0002

NBDL GIANT: 09:17 10/13/92

Page 13

35mm Still Camera System for Head Anthropometry of

HRV # = 0253

T R I A N G U L A T E D O B J E C T P O I N T S

Ident		Position (meters)	Covariance Matrix				Std Dev (m)
mrc5	*0*	X =	0.0549	+3.259E-08	+5.252E-10	-9.521E-10	0.0002
		Y =	-0.0481	+5.252E-10	+3.239E-08	+1.225E-10	0.0002
		Z =	0.0045	-9.521E-10	+1.225E-10	+3.217E-08	0.0002
mrc6	*0*	X =	0.0549	+3.306E-08	+7.095E-10	-4.301E-10	0.0002
		Y =	-0.0482	+7.095E-10	+3.358E-08	-2.567E-11	0.0002
		Z =	-0.0203	-4.301E-10	-2.567E-11	+3.285E-08	0.0002
mrc8	*0*	X =	0.0549	+3.333E-08	+4.665E-10	-1.126E-09	0.0002
		Y =	-0.0238	+4.665E-10	+3.257E-08	-2.258E-10	0.0002
		Z =	0.0046	-1.126E-09	-2.258E-10	+3.268E-08	0.0002
rtc1		X =	0.2427	+1.416E-06	+5.186E-08	-4.416E-08	0.0012
		Y =	-0.2610	+5.186E-08	+1.498E-06	-8.627E-08	0.0012
		Z =	-0.2899	-4.416E-08	-8.627E-08	+1.364E-06	0.0012
rtc2		X =	0.2655	+1.645E-06	+3.787E-08	-3.115E-08	0.0013
		Y =	-0.2598	+3.787E-08	+1.731E-06	-1.063E-07	0.0013
		Z =	-0.3364	-3.115E-08	-1.063E-07	+1.546E-06	0.0012
rtc3		X =	0.2670	+1.540E-06	+2.198E-08	-2.060E-08	0.0012
		Y =	-0.2098	+2.198E-08	+1.645E-06	-1.063E-07	0.0013
		Z =	-0.3358	-2.060E-08	-1.063E-07	+1.414E-06	0.0012
rtc4		X =	0.2446	+1.311E-06	+3.896E-08	-3.290E-08	0.0011
		Y =	-0.2103	+3.896E-08	+1.410E-06	-8.941E-08	0.0012
		Z =	-0.2894	-3.290E-08	-8.941E-08	+1.233E-06	0.0011
rtc5		X =	0.2899	+1.776E-06	+9.493E-08	-1.403E-07	0.0013
		Y =	-0.2617	+9.493E-08	+1.698E-06	+3.421E-08	0.0013
		Z =	-0.2681	-1.403E-07	+3.421E-08	+1.822E-06	0.0013
rtc6		X =	0.3112	+2.191E-06	+5.082E-07	-5.069E-08	0.0015
		Y =	-0.2623	+5.082E-07	+2.333E-06	-1.647E-07	0.0015
		Z =	-0.3133	-5.069E-08	-1.647E-07	+1.855E-06	0.0014

NAVAL BIODYNAMICS LABORATORY SOFTWARE DOCUMENTATION

rtc8	X =	0.2937	+1.629E-06	+2.014E-08	-1.823E-07	0.0013
	Y =	-0.2114	+2.014E-08	+1.537E-06	-1.577E-07	0.0012
	Z =	-0.2681	-1.823E-07	-1.577E-07	+1.532E-06	0.0012
ear1-l	X =	0.0831	+5.635E-07	-4.894E-08	-9.703E-08	0.0008
	Y =	0.1796	-4.894E-08	+5.613E-07	-7.388E-08	0.0007
	Z =	-0.0902	-9.703E-08	-7.388E-08	+5.144E-07	0.0007
ear1-r	X =	0.0725	+5.881E-07	+1.725E-08	-1.153E-07	0.0008
	Y =	-0.1730	+1.725E-08	+6.106E-07	+3.589E-08	0.0008
	Z =	-0.1123	-1.153E-07	+3.589E-08	+5.572E-07	0.0007
ear2-l	X =	0.0752	+5.426E-07	-5.162E-08	-1.011E-07	0.0007
	Y =	0.1590	-5.162E-08	+5.530E-07	-6.557E-08	0.0007
	Z =	-0.1026	-1.011E-07	-6.557E-08	+4.941E-07	0.0007

NBDL GIANT: 09:17 10/13/92 Page 14
 35mm Still Camera System for Head Anthropometry of HRV # = 0253

TRIANGULATED OBJECT POINTS

Ident	Position (meters)	Covariance Matrix	Std Dev (m)
ear2-r	X = 0.0653	+5.642E-07 +1.285E-08 -1.145E-07	0.0008
	Y = -0.1502	+1.285E-08 +5.876E-07 +3.230E-08	0.0008
	Z = -0.1212	-1.145E-07 +3.230E-08 +5.234E-07	0.0007
ear3-l	X = 0.0683	+5.285E-07 -5.445E-08 -1.054E-07	0.0007
	Y = 0.1377	-5.445E-08 +5.491E-07 -5.835E-08	0.0007
	Z = -0.1152	-1.054E-07 -5.835E-08 +4.796E-07	0.0007
ear3-r	X = 0.0572	+6.725E-07 +9.706E-08 -1.714E-07	0.0008
	Y = -0.1275	+9.706E-08 +6.311E-07 -1.327E-08	0.0008
	Z = -0.1294	-1.714E-07 -1.327E-08 +6.013E-07	0.0008
ear4-l	X = 0.0604	+5.196E-07 -5.673E-08 -1.099E-07	0.0007
	Y = 0.1170	-5.673E-08 +5.487E-07 -5.244E-08	0.0007
	Z = -0.1270	-1.099E-07 -5.244E-08 +4.706E-07	0.0007
ear4-r	X = 0.0494	+6.671E-07 +9.644E-08 -1.787E-07	0.0008
	Y = -0.1045	+9.644E-08 +6.230E-07 -1.771E-08	0.0008
	Z = -0.1384	-1.787E-07 -1.771E-08 +5.885E-07	0.0008
* g	X = 0.4191	+3.957E-05 -4.091E-06 -4.325E-05	0.0063
	Y = -0.3568	-4.091E-06 +1.175E-05 +4.562E-06	0.0034
	Z = -1.2174	-4.325E-05 +4.562E-06 +7.604E-05	0.0087
* h	X = 0.4381	+4.878E-05 +2.010E-05 -5.626E-05	0.0070
	Y = 0.5933	+2.010E-05 +2.442E-05 -3.105E-05	0.0049
	Z = -1.2110	-5.626E-05 -3.105E-05 +9.616E-05	0.0098

SUMMARY STATISTICS FOR OBJECT POINTS

RMS For Standard Deviations

Count = 37	X =	0.0021 meters
Count = 37	Y =	0.0017 meters

Anthropometry and Initial Conditions Photogrammetric Program

Count = 37 Z = 0.0026 meters

NBDL GIANT: 09:17 10/13/92

Page 15

35mm Still Camera System for Head Anthropometry of

HRV # = 0253

C O R R E C T I O N S A P P L I E D T O O B J E C T C O N T R O L

	X =	0.0000 m		X =	0.0000 m
mcc1	Y =	0.0000 m	mlc1	Y =	0.0001 m
	Z =	0.0001 m		Z =	0.0000 m
	X =	0.0000 m		X =	0.0000 m
mrc1	Y =	0.0001 m	mcc2	Y =	-0.0001 m
	Z =	-0.0001 m		Z =	0.0003 m
	X =	0.0000 m		X =	0.0001 m
mlc2	Y =	0.0000 m	mrc2	Y =	0.0000 m
	Z =	0.0000 m		Z =	-0.0001 m
	X =	0.0001 m		X =	0.0000 m
mcc3	Y =	-0.0001 m	mlc3	Y =	0.0000 m
	Z =	0.0002 m		Z =	-0.0001 m
	X =	0.0000 m		X =	0.0000 m
mrc3	Y =	0.0000 m	mcc4	Y =	-0.0001 m
	Z =	0.0000 m		Z =	0.0000 m
	X =	-0.0001 m		X =	0.0000 m
mlc4	Y =	0.0000 m	mrc4	Y =	0.0000 m
	Z =	-0.0002 m		Z =	-0.0001 m
	X =	-0.0001 m		X =	0.0000 m
mcc5	Y =	0.0000 m	mlc5	Y =	0.0001 m
	Z =	0.0001 m		Z =	-0.0001 m
	X =	0.0000 m		X =	0.0000 m
mrc5	Y =	0.0000 m	mcc6	Y =	0.0000 m
	Z =	-0.0001 m		Z =	0.0000 m
	X =	0.0000 m		X =	0.0000 m
mrc6	Y =	0.0000 m	mcc7	Y =	-0.0001 m
	Z =	0.0000 m		Z =	0.0001 m
	X =	0.0000 m		X =	0.0000 m
mlc7	Y =	0.0001 m	mcc8	Y =	-0.0001 m
	Z =	-0.0001 m		Z =	0.0000 m
	X =	0.0000 m		X =	0.0000 m
mlc8	Y =	0.0000 m	mrc8	Y =	0.0000 m
	Z =	-0.0001 m		Z =	0.0001 m

X Number of Components =	22	RMS =	0.0000 meters
Y Number of Components =	22	RMS =	0.0001 meters
Z Number of Components =	22	RMS =	0.0001 meters

NAVAL BIODYNAMICS LABORATORY SOFTWARE DOCUMENTATION

NBDL GIANT: 09:17 10/13/92 Page 16
35mm Still Camera System for Head Anthropometry of HRV # = 0253

ANTHROPOMETRY OUTPUT

T-PLATE ORIGIN WITH RESPECT TO HEAD ANATOMICAL ORIGIN

X= 15.7009cm Y= -0.1695cm Z= -5.4439cm

T-PLATE ORIENTATION WITH RESPECT TO HEAD ANATOMICAL SYSTEM

-0.508605	0.082581	-0.857030
-0.007191	0.994948	0.100138
0.860970	0.057093	-0.505442

Anthropometry and Initial Conditions Photogrammetric Program

Body Anthropometry Output File

NBDL GIANT: 18:02 10/08/92

X-Ray Determination of Body Anthropometry of

Page 1
HRV # = 0253

Object Space Reference System is Rectangular

Rotation angles are Terrestrial Object-to-Photo

Complete Triangulation process is requested

Error Propagation is requested

[Eigenvector/Eigenvalue output]

Unit Variance will be based on completely free camera parameters

All Image Residuals will be listed

Triangulated Object Coordinates will be saved

Adjusted Camera Station Parameters will be saved

NBDL GIANT: 18:02 10/08/92

X-Ray Determination of Body Anthropometry of

Page 2
HRV # = 0253

ERROR WARNINGS

PASS POINTS APPEARING ON 1 PHOTO

*Rib_Rt	*r2	*r3	*r4
*r6	*c7	*c8	

NBDL GIANT: 18:02 10/08/92

X-Ray Determination of Body Anthropometry of

Page 3
HRV # = 0253

CAMERA STATIONS CORRECTIONS

----- POSITION ----- ATTITUDE -----

X	Y	Z	Azim.	Elev.	Swing
---	---	---	-------	-------	-------

			Iteration 1			
LfEyLfSh	0.0025	0.0026	0.0043 m.	0.005165	-0.008976	0.009395
RtEyLfSh	0.0048	0.0016	-0.0042 m.	0.006387	0.007221	-0.004892
LfEyRtSh	-0.0002	0.0003	-0.0015 m.	-0.000130	-0.002379	0.007539
RtEyRtSh	-0.0007	0.0005	-0.0014 m.	-0.000203	-0.002936	0.006722

Provisional Weighted Sum of Squares = 2007.91

NAVAL BIODYNAMICS LABORATORY SOFTWARE DOCUMENTATION

				Iteration	2		
LfEyLfSh	-0.0002	-0.0001	0.0001 m.	-0.000245	-0.000300	0.000168	
RtEyLfSh	-0.0001	0.0000	0.0000 m.	-0.000042	0.000029	-0.000182	
LfEyRtSh	0.0000	-0.0001	0.0000 m.	0.000029	0.000073	0.000043	
RtEyRtSh	0.0000	-0.0001	0.0000 m.	0.000008	0.000065	0.000017	

Provisional Weighted Sum of Squares = 1953.95

				Iteration	3		
LfEyLfSh	0.0000	0.0000	0.0000 m.	0.000005	-0.000019	0.000019	
RtEyLfSh	0.0000	0.0000	0.0000 m.	0.000006	0.000010	0.000010	
LfEyRtSh	0.0000	0.0000	0.0000 m.	0.000000	-0.000004	0.000012	
RtEyRtSh	0.0000	0.0000	0.0000 m.	0.000002	-0.000008	0.000009	

Provisional Weighted Sum of Squares = 1953.89

NBDL GIANT: 18:02 10/08/92

X-Ray Determination of Body Anthropometry of

Page 4

HRV # = 0253

TRIANGULATED IMAGE POINTS RESIDUALS
(in micrometers)

Origin	LfEyLfSh	RtEyLfSh	LfEyRtSh	RtEyRtSh
	-840	738	1457	-1651
	-6245	1065	3951	1370
Rib_Lf	LfEyLfSh	RtEyLfSh	LfEyRtSh	RtEyRtSh
	-2922	2985	-754	620
	-319	5515	-3151	-1763
SpineTop	RtEyLfSh	LfEyRtSh	LfEyLfSh	RtEyRtSh
	-2434	-4097	2648	4163
	-2796	2288	-2641	3347
SpineBot	LfEyLfSh	RtEyLfSh	LfEyRtSh	RtEyRtSh
	1913	-1851	-921	999
	-2159	-2338	2259	2391
spine_bb	LfEyLfSh	RtEyLfSh	LfEyRtSh	RtEyRtSh
	174	-139	470	-300
	2020	2154	-2039	-2198
sternum	RtEyLfSh	LfEyLfSh	LfEyRtSh	RtEyRtSh
	-952	-135	223	-1040
	5370	3514	-4608	-4657
*lf_shol	RtEyLfSh	LfEyLfSh		
	-31	29		
	-217	216		
lneckT	RtEyLfSh	LfEyLfSh	RtEyRtSh	
	943	-987	-121	
	-1336	325	794	
lneckB	LfEyLfSh	RtEyLfSh	RtEyRtSh	
	-776	794	-48	
	411	-717	237	

Anthropometry and Initial Conditions Photogrammetric Program

rneckT	LfEyLfSh	LfEyRtSh	RtEyRtSh
	-180	1000	-1227
	-2664	1930	1367

rneckB	LfEyRtSh	LfEyLfSh	RtEyRtSh
	1200	80	-1126
	2650	-3863	2151

*r1	RtEyLfSh	LfEyLfSh
	-10	9
	-85	84

r2 *0*	LfEyLfSh	LfEyRtSh	RtEyRtSh
	-6040	1492	3314
	4211	-4083	-3908

NBDL GIANT: 18:02 10/08/92

Page 5

X-Ray Determination of Body Anthropometry of

HRV # = 0253

T R I A N G U L A T E D I M A G E P O I N T S R E S I D U A L S
(in micrometers)

r3 *0*	LfEyRtSh	LfEyLfSh	RtEyRtSh
	-141	6566	-412
	-1718	-607	-1227

r4 *0*	LfEyLfSh	LfEyRtSh	RtEyRtSh
	5828	1243	1229
	-3163	-132	94

*r5	RtEyLfSh	LfEyLfSh
	-36	33
	-293	290

r6 *0*	LfEyRtSh	LfEyLfSh	RtEyRtSh
	899	-8332	67
	-2349	7127	-1180

r7 *0*	LfEyLfSh	RtEyLfSh	LfEyRtSh	RtEyRtSh
	2531	3209	1158	-1612
	1654	1369	579	1199

r8 *0*	LfEyLfSh	LfEyRtSh	RtEyLfSh	RtEyRtSh
	1955	-73	2169	-2293
	1003	2184	221	2579

c1 *0*	LfEyRtSh	LfEyLfSh	RtEyLfSh	RtEyRtSh
	-2802	-2426	-1398	-165
	-2144	1603	1046	-2066

c2 *0*	RtEyLfSh	LfEyLfSh	LfEyRtSh	RtEyRtSh
	-1015	-1625	-2410	109
	2833	2865	-1614	-1213

*c3	LfEyLfSh	RtEyLfSh
	-1	1

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	-10	10	
*c4	LfEyLfSh	RtEyLfSh	
	3	-3	
	27	-27	
*c5	LfEyLfSh	RtEyLfSh	
	23	-25	
	202	-203	
*c6	RtEyLfSh	LfEyLfSh	
	-20	19	
	-164	163	
c7 *0*	LfEyRtSh	LfEyLfSh	RtEyRtSh
	1549	5266	-11
	3414	-3835	3369

NBDL GIANT: 18:02 10/08/92

X-Ray Determination of Body Anthropometry of

Page 6
HRV # = 0253

TRIANGULATED IMAGE POINTS RESIDUALS
(in micrometers)

c8 *0*	LfEyLfSh	LfEyRtSh	RtEyRtSh	
	6351	2252	565	
	-7500	5856	5982	
11 *0*	LfEyRtSh	RtEyLfSh	LfEyLfSh	RtEyRtSh
	-1957	-1100	-1993	516
	-4701	1073	2110	-4981
12 *0*	LfEyRtSh	LfEyLfSh	RtEyLfSh	RtEyRtSh
	-2089	-830	27	-126
	-3692	1429	631	-4595
13 *0*	LfEyRtSh	RtEyLfSh	LfEyLfSh	RtEyRtSh
	-248	1449	-2019	-715
	-941	-3248	-2267	-1762
14 *0*	LfEyRtSh	LfEyLfSh	RtEyLfSh	RtEyRtSh
	2224	-2825	1123	2073
	897	-2620	-3827	486
15 *0*	LfEyLfSh	RtEyLfSh	LfEyRtSh	RtEyRtSh
	913	-1416	-1608	-1891
	4948	4235	-1051	-1803
16 *0*	RtEyLfSh	LfEyRtSh	LfEyLfSh	RtEyRtSh
	-2065	785	151	-353
	2762	-1693	3150	-2085
17 *0*	LfEyLfSh	LfEyRtSh	RtEyLfSh	RtEyRtSh
	-2795	2695	-1900	-616
	158	1626	-687	881

Anthropometry and Initial Conditions Photogrammetric Program

```

18 *0*  LfEyLfSh RtEyLfSh LfEyRtSh RtEyRtSh
          408      1124      1872      -953
          210      -649      3968      4023
    
```

```

Rib_Rt      RtEyRtSh LfEyRtSh RtEyLfSh
            175      -565      -71
            6806      5845     -11729
    
```

```

*rt_shol    RtEyRtSh LfEyRtSh
            13       -14
           -311      311
    
```

```

r1 *0*  LfEyRtSh RtEyRtSh
          -109      2134
          -4870     -4113
    
```

```

r5 *0*  LfEyRtSh RtEyRtSh
          -259      -301
          -1964     -1193
    
```

NBDL GIANT: 18:02 10/08/92

X-Ray Determination of Body Anthropometry of

Page 7
HRV # = 0253

T R I A N G U L A T E D I M A G E P O I N T S R E S I D U A L S
(in micrometers)

```

c3 *0*  RtEyRtSh LfEyRtSh
          -923      -1148
          -1887     -1463
    
```

```

c4 *0*  RtEyRtSh LfEyRtSh
          1345      926
          2300      2868
    
```

```

c5 *0*  RtEyRtSh LfEyRtSh
          -477      -1181
          1753      1660
    
```

```

c6 *0*  LfEyRtSh RtEyRtSh
          -1104     -900
           32       -46
    
```

```

Weighted Sum of Squares (Camera) =          2.2
Weighted Sum of Squares (Object) =         118.5
Weighted Sum of Squares (Plates) =        1684.7
    
```

```

Weighted Sum of Squares (Total) =        1805.4
Degrees of Freedom..... =          185
    
```

a posteriori Variance of Unit Weight = 9.759

NAVAL BIODYNAMICS LABORATORY SOFTWARE DOCUMENTATION

NBDL GIANT: 18:02 10/08/92 Page 8
X-Ray Determination of Body Anthropometry of HRV # = 0253

TRIANGULATED CAMERA STATIONS (Terrestrial->Ph)

Ident	Position	Error Ellipsoid	--->	Length
LfEyLfSh	X =	0.5084 m.	+0.7931 +0.6089 -0.0123	0.0100 m.
	Y =	-0.4485 m.	-0.4864 +0.6211 -0.6146	0.0079 m.
	Z =	-0.0755 m.	+0.3666 -0.4934 -0.7888	0.0071 m.
	Azim. = 315 02 6.4341			00 51 22.2323
Attitude:	Elev. =	00 33 32.6112	Std Dev:	00 51 22.2323
	Swing =	00 27 5.6771		00 52 48.4597
RtEyLfSh	X =	0.5527 m.	+0.4902 +0.8711 -0.0279	0.0111 m.
	Y =	-0.4114 m.	+0.8186 -0.4492 +0.3578	0.0090 m.
	Z =	-0.0822 m.	-0.2991 +0.1983 +0.9334	0.0076 m.
	Azim. = 314 45 41.7829			00 56 14.3432
Attitude:	Elev. =	00 01 9.6575	Std Dev:	00 56 14.3432
	Swing =	01 01 21.4765		00 56 3.6139
LfEyRtSh	X =	0.5147 m.	-0.7583 +0.6506 +0.0412	0.0083 m.
	Y =	0.4702 m.	-0.6488 -0.7470 -0.1452	0.0073 m.
	Z =	-0.0695 m.	+0.0636 +0.1369 -0.9885	0.0070 m.
	Azim. = 222 37 35.9298			00 42 11.5625
Attitude:	Elev. =	01 24 18.3679	Std Dev:	00 42 11.5625
	Swing =	01 14 38.0329		00 48 16.2198
RtEyRtSh	X =	0.4822 m.	+0.7947 -0.6049 -0.0513	0.0084 m.
	Y =	0.4995 m.	-0.5811 -0.7336 -0.3523	0.0072 m.
	Z =	-0.0684 m.	-0.1754 -0.3098 +0.9345	0.0069 m.
	Azim. = 222 18 17.0390			00 42 31.7849
Attitude:	Elev. =	01 31 6.6971	Std Dev:	00 42 31.7849
	Swing =	01 03 31.7206		00 46 42.5383

SUMMARY STATISTICS FOR CAMERA STATIONS

RMS For Standard Deviations

Count = 4	X =	0.0087 m.	Azim. =	00 48 27.1792
	Y =	0.0087 m.	Elev. =	00 52 32.7915
	Z =	0.0073 m.	Swing =	00 51 5.7522

NBDL GIANT: 18:02 10/08/92 Page 9
X-Ray Determination of Body Anthropometry of HRV # = 0253

TRIANGULATED OBJECT POINTS

Ident	Position (meters)	Error Ellipsoid	--->	Length (m)
	X =	-0.0307	+9.815E-01 +1.433E-01 -1.268E-01	0.0007

Anthropometry and Initial Conditions Photogrammetric Program

c1	*0*	Y =	-0.0069	-1.418E-01	+9.897E-01	+2.034E-02	0.0007
		Z =	0.0019	+1.284E-01	-1.986E-03	+9.917E-01	0.0007
		X =	-0.0307	-9.866E-01	-1.380E-01	+8.723E-02	0.0007
c2	*0*	Y =	-0.0066	+1.367E-01	-9.904E-01	-2.103E-02	0.0007
		Z =	-0.0189	+8.930E-02	-8.821E-03	+9.960E-01	0.0007
		X =	-0.0308	-7.457E-01	-6.631E-01	+6.500E-02	0.0008
c3	*0*	Y =	0.0144	+6.000E-01	-6.259E-01	+4.983E-01	0.0007
		Z =	-0.0226	+2.897E-01	-4.106E-01	-8.646E-01	0.0007
		X =	-0.0309	-7.446E-01	-6.598E-01	+1.007E-01	0.0008
c4	*0*	Y =	0.0156	-6.509E-01	+6.845E-01	-3.284E-01	0.0007
		Z =	0.0022	-1.478E-01	+3.101E-01	+9.392E-01	0.0007
		X =	-0.0082	-7.134E-01	-6.935E-01	+1.008E-01	0.0008
c5	*0*	Y =	-0.0075	-6.982E-01	+6.912E-01	-1.866E-01	0.0007
		Z =	0.0023	-5.974E-02	+2.034E-01	+9.773E-01	0.0007
		X =	-0.0085	-7.147E-01	-6.960E-01	+6.915E-02	0.0008
c6	*0*	Y =	-0.0087	-6.824E-01	+6.721E-01	-2.874E-01	0.0007
		Z =	-0.0199	-1.536E-01	+2.526E-01	+9.553E-01	0.0007
		X =	-0.0081	+7.933E-01	+6.045E-01	-7.227E-02	0.0008
c7	*0*	Y =	0.0151	-6.025E-01	+7.966E-01	+4.928E-02	0.0007
		Z =	-0.0208	+8.736E-02	+4.449E-03	+9.962E-01	0.0007
		X =	-0.0078	+7.914E-01	+6.014E-01	-1.096E-01	0.0008
c8	*0*	Y =	0.0158	-5.978E-01	+7.988E-01	+6.757E-02	0.0007
		Z =	0.0018	+1.282E-01	+1.207E-02	+9.917E-01	0.0007
		X =	0.0306	+9.205E-01	+3.652E-01	-1.392E-01	0.0007
11	*0*	Y =	0.0334	-3.617E-01	+9.309E-01	+5.044E-02	0.0007
		Z =	0.0037	+1.480E-01	+3.909E-03	+9.890E-01	0.0007
		X =	0.0307	-9.164E-01	-3.895E-01	+9.202E-02	0.0007
12	*0*	Y =	0.0340	+3.867E-01	-9.210E-01	-4.744E-02	0.0007
		Z =	-0.0197	+1.032E-01	-7.892E-03	+9.946E-01	0.0007
		X =	0.0311	+8.569E-01	+5.083E-01	-8.555E-02	0.0007
13	*0*	Y =	0.0551	-5.050E-01	+8.612E-01	+5.842E-02	0.0007
		Z =	-0.0200	+1.034E-01	-6.863E-03	+9.946E-01	0.0007
		X =	0.0306	+8.619E-01	+4.889E-01	-1.347E-01	0.0007
14	*0*	Y =	0.0562	-4.850E-01	+8.723E-01	+6.224E-02	0.0007
		Z =	0.0037	+1.479E-01	+1.169E-02	+9.889E-01	0.0007
		X =	0.0536	+8.464E-01	+5.146E-01	-1.370E-01	0.0007
15	*0*	Y =	0.0343	-5.088E-01	+8.574E-01	+7.728E-02	0.0007
		Z =	0.0027	+1.572E-01	+4.270E-03	+9.876E-01	0.0007

NAVAL BIODYNAMICS LABORATORY SOFTWARE DOCUMENTATION

NBDL GIANT: 18:02 10/08/92

X-Ray Determination of Body Anthropometry of

Page 10
HRV # = 0253

TRIANGULATED OBJECT POINTS

Ident	Position (meters)	Error Ellipsoid --->	Length (m)
16	X = 0.0527	-8.176E-01 -5.692E-01 +8.745E-02	0.0007
	0 Y = 0.0341	+5.649E-01 -8.222E-01 -7.000E-02	0.0007
	Z = -0.0202	+1.117E-01 -7.829E-03 +9.937E-01	0.0007
17	X = 0.0520	+7.662E-01 +6.372E-01 -8.251E-02	0.0007
	0 Y = 0.0556	-6.326E-01 +7.707E-01 +7.658E-02	0.0007
	Z = -0.0208	+1.124E-01 -6.481E-03 +9.936E-01	0.0007
18	X = 0.0538	+7.851E-01 +6.047E-01 -1.338E-01	0.0007
	0 Y = 0.0559	-5.988E-01 +7.963E-01 +8.560E-02	0.0007
	Z = 0.0025	+1.583E-01 +1.293E-02 +9.873E-01	0.0007
r1	X = 0.0327	-6.557E-01 -7.481E-01 +1.021E-01	0.0008
	0 Y = -0.0468	-7.515E-01 +6.335E-01 -1.842E-01	0.0007
	Z = 0.0042	-7.314E-02 +1.975E-01 +9.776E-01	0.0007
r2	X = 0.0315	+6.709E-01 +7.389E-01 -6.259E-02	0.0007
	0 Y = -0.0458	-7.341E-01 +6.737E-01 +8.462E-02	0.0007
	Z = -0.0217	+1.047E-01 -1.082E-02 +9.944E-01	0.0007
r3	X = 0.0305	+6.905E-01 +7.203E-01 -6.608E-02	0.0007
	0 Y = -0.0245	-7.160E-01 +6.936E-01 +7.874E-02	0.0007
	Z = -0.0215	+1.025E-01 -7.056E-03 +9.947E-01	0.0007
r4	X = 0.0313	+6.926E-01 +7.141E-01 -1.023E-01	0.0007
	0 Y = -0.0247	-7.048E-01 +7.000E-01 +1.148E-01	0.0007
	Z = 0.0031	+1.535E-01 -7.394E-03 +9.881E-01	0.0007
r5	X = 0.0523	-6.400E-01 -7.614E-01 +1.033E-01	0.0008
	0 Y = -0.0460	+6.379E-01 -4.515E-01 +6.238E-01	0.0007
	Z = 0.0033	+4.284E-01 -4.651E-01 -7.747E-01	0.0007
r6	X = 0.0526	+6.057E-01 +7.935E-01 -6.004E-02	0.0007
	0 Y = -0.0461	-7.879E-01 +6.085E-01 +9.457E-02	0.0007
	Z = -0.0223	+1.116E-01 -9.970E-03 +9.937E-01	0.0007
r7	X = 0.0522	-9.906E-01 +7.748E-02 +1.127E-01	0.0007
	0 Y = -0.0235	+7.886E-02 +9.969E-01 +7.844E-03	0.0007
	Z = -0.0220	-1.118E-01 +1.666E-02 -9.936E-01	0.0007
r8	X = 0.0528	-9.820E-01 -1.066E-01 +1.562E-01	0.0007
	0 Y = -0.0245	+1.016E-01 -9.940E-01 -3.942E-02	0.0007
	Z = 0.0028	+1.595E-01 -2.283E-02 +9.869E-01	0.0007
*c3	X = 0.0303	-7.906E-01 +6.058E-01 +8.898E-02	0.0392
	Y = -0.0491	+6.104E-01 +7.913E-01 +3.602E-02	0.0019
	Z = -0.0228	+4.859E-02 -8.279E-02 +9.954E-01	0.0018
*c4	X = 0.0359	-7.857E-01 +6.052E-01 +1.277E-01	0.0393
	Y = -0.0518	-6.130E-01 -7.344E-01 -2.913E-01	0.0019
	Z = 0.0012	+8.251E-02 +3.072E-01 -9.481E-01	0.0018

Anthropometry and Initial Conditions Photogrammetric Program

NBDL GIANT: 18:02 10/08/92

Page 11

X-Ray Determination of Body Anthropometry of

HRV # = 0253

T R I A N G U L A T E D O B J E C T P O I N T S

Ident	Position (meters)	Error Ellipsoid --->	Length (m)
*c5	X = -0.0211	-7.770E-01 +6.196E-01 +1.111E-01	0.0479
	Y = 0.0089	-6.295E-01 -7.632E-01 -1.461E-01	0.0020
	Z = -0.0001	+5.686E-03 +1.835E-01 -9.830E-01	0.0020
*c6	X = -0.0241	-7.790E-01 +6.216E-01 +8.169E-02	0.0481
	Y = 0.0117	-6.246E-01 -7.581E-01 -1.877E-01	0.0020
	Z = -0.0208	+5.477E-02 +1.973E-01 -9.788E-01	0.0020
*r1	X = -0.0025	-7.803E-01 +6.146E-01 +1.157E-01	0.0444
	Y = -0.0116	-5.988E-01 -6.808E-01 -4.220E-01	0.0019
	Z = 0.0000	+1.806E-01 +3.986E-01 -8.992E-01	0.0019
*r5	X = -0.0043	-7.650E-01 +6.340E-01 +1.133E-01	0.0461
	Y = 0.0123	-6.436E-01 -7.455E-01 -1.734E-01	0.0019
	Z = 0.0002	+2.548E-02 +2.056E-01 -9.783E-01	0.0019
Origin	X = 0.1667	+1.696E-01 +9.855E-01 +9.441E-03	0.0027
	Y = 0.0054	-9.854E-01 +1.694E-01 +1.891E-02	0.0022
	Z = -0.0751	+1.704E-02 -1.251E-02 +9.998E-01	0.0017
Rib_Lf	X = 0.1409	+1.751E-01 +9.844E-01 +1.807E-02	0.0024
	Y = 0.0370	-9.845E-01 +1.748E-01 +1.329E-02	0.0021
	Z = -0.0784	+9.927E-03 -2.012E-02 +9.997E-01	0.0016
Rib_Rt	X = 0.1447	+4.646E-01 +8.855E-01 +2.799E-03	0.0030
	Y = -0.0192	+8.855E-01 -4.646E-01 +1.504E-03	0.0022
	Z = -0.0759	+2.633E-03 +1.780E-03 -1.000E+00	0.0018
lneckB	X = -0.0451	+9.969E-01 -5.515E-02 +5.554E-02	0.0032
	Y = 0.1152	+5.130E-02 +9.963E-01 +6.852E-02	0.0027
	Z = -0.0984	-5.912E-02 -6.546E-02 +9.961E-01	0.0021
lneckT	X = -0.0458	-9.968E-01 +5.720E-02 +5.556E-02	0.0031
	Y = 0.1179	-5.829E-02 -9.981E-01 -1.821E-02	0.0026
	Z = -0.0348	+5.442E-02 -2.139E-02 +9.983E-01	0.0020
rneckB	X = -0.0397	+9.019E-01 +4.276E-01 +6.137E-02	0.0031
	Y = -0.0949	-4.259E-01 +9.039E-01 -3.969E-02	0.0025
	Z = -0.1014	-7.244E-02 +9.657E-03 +9.973E-01	0.0021
rneckT	X = -0.0396	+8.963E-01 +4.410E-01 -4.694E-02	0.0030
	Y = -0.0943	-4.399E-01 +8.975E-01 +3.257E-02	0.0024
	Z = -0.0381	+5.649E-02 -8.540E-03 +9.984E-01	0.0019
sternum	X = 0.1819	-1.622E-01 -9.866E-01 -1.854E-02	0.0031
	Y = -0.0004	-9.776E-01 +1.632E-01 -1.328E-01	0.0025
	Z = -0.1312	-1.340E-01 +3.408E-03 +9.910E-01	0.0020
*lf_shol	X = -0.0256	+6.997E-01 -7.054E-01 +1.127E-01	0.0690
	Y = 0.1266	-6.911E-01 -7.084E-01 -1.432E-01	0.0032
	Z = -0.1676	-1.809E-01 -2.232E-02 +9.832E-01	0.0030

NAVAL BIODYNAMICS LABORATORY SOFTWARE DOCUMENTATION

NBDL GIANT: 18:02 10/08/92

X-Ray Determination of Body Anthropometry of

Page 12
HRV # = 0253

TRIANGULATED OBJECT POINTS

Ident	Position (meters)	Error Ellipsoid --->	Length (m)
*rt_shol	X = -0.0638	+6.507E-01 +7.482E-01 +1.297E-01	0.1109
	Y = -0.1608	-7.291E-01 +6.633E-01 -1.684E-01	0.0034
	Z = -0.1809	+2.120E-01 -1.502E-02 -9.771E-01	0.0033
SpineBot	X = 0.0915	+1.834E-01 +9.830E-01 +6.529E-03	0.0021
	Y = -0.0002	+9.830E-01 -1.833E-01 -6.239E-03	0.0020
	Z = -0.0771	-4.936E-03 +7.563E-03 -1.000E+00	0.0015
SpineTop	X = 0.0974	+1.730E-01 +9.849E-01 +4.707E-03	0.0021
	Y = -0.0016	-9.847E-01 +1.729E-01 +2.196E-02	0.0020
	Z = -0.0703	-2.082E-02 +8.434E-03 -9.997E-01	0.0015
spine_bb	X = 0.0591	+6.670E-01 +7.450E-01 -2.066E-03	0.0019
	Y = 0.0043	-7.448E-01 +6.669E-01 +2.026E-02	0.0019
	Z = -0.0683	-1.647E-02 +1.198E-02 -9.998E-01	0.0014

SUMMARY STATISTICS FOR OBJECT POINTS

RMS For Standard Deviations

Count = 19	X =	0.0279 meters
Count = 19	Y =	0.0270 meters
Count = 19	Z =	0.0050 meters

NBDL GIANT: 18:02 10/08/92

X-Ray Determination of Body Anthropometry of

Page 13
HRV # = 0253

CORRECTIONS APPLIED TO OBJECT CONTROL

c1	X = 0.0000 m	11	X = 0.0001 m
	Y = 0.0004 m		Y = 0.0004 m
	Z = 0.0001 m		Z = 0.0005 m
r1	X = 0.0002 m	c2	X = 0.0000 m
	Y = 0.0000 m		Y = 0.0003 m
	Z = 0.0007 m		Z = -0.0002 m
12	X = -0.0001 m	r2	X = 0.0006 m
	Y = 0.0002 m		Y = 0.0002 m
	Z = 0.0005 m		Z = 0.0002 m
c3	X = -0.0001 m	13	X = 0.0000 m
	Y = 0.0001 m		Y = 0.0001 m
	Z = 0.0002 m		Z = 0.0006 m
r3	X = -0.0004 m	c4	X = 0.0001 m
	Y = -0.0004 m		Y = -0.0002 m
	Z = 0.0003 m		Z = -0.0004 m

Anthropometry and Initial Conditions Photogrammetric Program

14	X =	0.0004 m	r4	X =	-0.0002 m
	Y =	-0.0002 m		Y =	-0.0005 m
	Z =	0.0004 m		Z =	0.0003 m
c5	X =	-0.0001 m	15	X =	-0.0002 m
	Y =	0.0001 m		Y =	0.0003 m
	Z =	-0.0003 m		Z =	-0.0005 m
r5	X =	0.0000 m	c6	X =	-0.0001 m
	Y =	0.0000 m		Y =	0.0001 m
	Z =	0.0002 m		Z =	0.0000 m
16	X =	0.0001 m	r6	X =	0.0005 m
	Y =	0.0001 m		Y =	0.0006 m
	Z =	-0.0001 m		Z =	-0.0003 m
c7	X =	-0.0002 m	17	X =	0.0004 m
	Y =	-0.0004 m		Y =	0.0001 m
	Z =	-0.0002 m		Z =	-0.0002 m
r7	X =	-0.0004 m	c8	X =	-0.0002 m
	Y =	-0.0003 m		Y =	-0.0006 m
	Z =	-0.0004 m		Z =	-0.0003 m
18	X =	-0.0001 m	r8	X =	-0.0004 m
	Y =	-0.0002 m		Y =	-0.0002 m
	Z =	-0.0007 m		Z =	-0.0005 m

X	Number of Components =	24	RMS =	0.0003 meters
Y	Number of Components =	24	RMS =	0.0003 meters
Z	Number of Components =	24	RMS =	0.0004 meters

NBDL GIANT: 18:02 10/08/92

Page 14

X-Ray Determination of Body Anthropometry of

HRV # = 0253

A N T H R O P O M E T R Y O U T P U T

T-PLATE ORIGIN WITH RESPECT TO BODY ANATOMICAL ORIGIN

X= -16.8052cm Y= 0.6003cm Z= 7.2123cm

T-PLATE ORIENTATION WITH RESPECT TO BODY ANATOMICAL SYSTEM

0.995966	-0.088285	0.016067
0.087475	0.995123	0.045594
-0.020014	-0.044004	0.998831

Site Survey Output File

NBDL GIANT: 15:15 03/25/92
azimuth - elevation - swing

Page 1

Object Space Reference System is Rectangular
Rotation angles are Terrestrial Object-to-Photo
Complete Triangulation process is requested
Error Propagation is requested
[Variance/Covariance output]

Unit Variance will be based on completely free camera parameters

All Image Residuals will be listed

Triangulated Object Coordinates will not be saved

Adjusted Camera Station Parameters will be saved

NBDL GIANT: 15:15 03/25/92
azimuth - elevation - swing

Page 2

ERROR WARNINGS

POINTS NOT PHOTOGRAPHED

rtc5

PASS POINTS APPEARING ON 1 PHOTO

xc6	xc	xx+24	c6
xz+12	yx+24	Xy-06	Xlfc4
lfc7			

Anthropometry and Initial Conditions Photogrammetric Program

NBDL GIANT: 15:15 03/25/92
azimuth - elevation - swing

Page 3

C A M E R A S T A T I O N S			C O R R E C T I O N S		
----- P O S I T I O N -----			----- A T T I T U D E -----		
X	Y	Z	Azim.	Elev.	Swing
Iteration 1					
#1	-0.0002	-0.0001	0.0002 m.	-0.000049	-0.000150 0.000101
#2	0.0001	-0.0003	0.0006 m.	-0.000029	-0.000243 0.000189
#3	-0.0005	0.0001	0.0001 m.	-0.000198	-0.000117 0.000093
#4	-0.0003	0.0000	0.0003 m.	-0.000156	0.000571 -0.000648
#5	-0.0006	0.0005	0.0001 m.	-0.000106	0.000123 -0.000365
#6	-0.0006	0.0000	0.0002 m.	-0.000126	-0.000143 -0.000197

Provisional Weighted Sum of Squares = 679.576

Iteration 2					
#1	0.0000	0.0000	0.0000 m.	-0.000001	0.000000 -0.000002
#2	0.0000	0.0000	0.0000 m.	-0.000004	0.000001 0.000001
#3	0.0000	0.0000	0.0000 m.	-0.000002	-0.000003 0.000003
#4	0.0000	0.0000	0.0000 m.	-0.000001	-0.000002 0.000001
#5	0.0000	0.0000	0.0000 m.	0.000001	-0.000002 0.000002
#6	0.0000	0.0000	0.0000 m.	0.000003	-0.000001 0.000001

Provisional Weighted Sum of Squares = 625.981

Iteration 3					
#1	0.0000	0.0000	0.0000 m.	0.000000	0.000000 0.000000
#2	0.0000	0.0000	0.0000 m.	0.000000	0.000000 0.000000
#3	0.0000	0.0000	0.0000 m.	0.000000	0.000000 0.000000
#4	0.0000	0.0000	0.0000 m.	0.000000	0.000000 0.000000
#5	0.0000	0.0000	0.0000 m.	0.000000	0.000000 0.000000
#6	0.0000	0.0000	0.0000 m.	0.000000	0.000000 0.000000

Provisional Weighted Sum of Squares = 625.954

NBDL GIANT: 15:15 03/25/92
azimuth - elevation - swing

Page 4

T R I A N G U L A T E D		I M A G E P O I N T S			R E S I D U A L S	
		(in micrometers)				
lfc1	#1	#2	#3	#4	#5	#6
	0	8	-15	-6	12	-17
	-1	-12	9	9	4	-8
lfc3	#1	#2	#3	#4	#5	#6
	17	2	-5	-9	27	-4
	8	-11	-11	1	0	6
lfc4	#2	#1	#3	#4	#5	
	1	6	-6	6	3	
	-4	2	-4	0	4	

NAVAL BIODYNAMICS LABORATORY SOFTWARE DOCUMENTATION

lfc6	#3 -22 9	#1 14 15	#6 -3 -16			
c1	#2 2 -13	#3 12 -2	#4 3 -4	#1 -7 -5	#5 0 15	#6 0 4
c2	#2 21 -3	#4 -3 1	#5 4 9	#1 -1 -6	#6 7 -3	
c3	#1 -6 -1	#2 12 -2	#3 14 -10	#4 0 -6	#5 -1 5	#6 14 9
c4	#2 10 -3	#1 -13 -5	#3 17 9	#4 0 0	#5 -15 -4	#6 15 4
c5	#1 -3 1	#3 1 -6	#2 0 4	#4 -1 -6	#5 0 6	
c7	#4 5 9	#1 18 -11	#5 3 17	#6 0 -15		
a	#2 22 -10	#3 -22 -26	#4 9 -3	#5 6 25	#1 -21 21	
b	#2 32 -6	#3 -27 -33	#1 -26 20	#4 4 8	#5 12 16	
rtc1 *0*	#1 4 -8	#3 -23 -9	#4 4 1	#2 4 0	#5 -7 -10	

NBDL GIANT: 15:15 03/25/92
azimuth - elevation - swing

Page 5

TRIANGULATED IMAGE POINTS RESIDUALS (in micrometers)

rtc2 *0*	#3 -11 32	#2 -16 19	#1 2 -21	#6 4 12
rtc3 *0*	#4 8 -5	#1 -3 19	#5 -7 -8	#6 19 -2
rtc6 *0*	#1 -15	#2 -30		

Anthropometry and Initial Conditions Photogrammetric Program

	7	19				
rtc7 *0*	#1 -36 -34					
sp1 *0*	#3 0 4	#4 0 -11	#5 -9 -9	#1 0 -6	#2 -15 -10	#6 -16 0
sp2 *0*	#4 -3 -13	#2 -20 13	#5 -21 -15	#1 8 -16	#3 6 2	#6 0 14
sp3 *0*	#2 -16 10	#3 9 -2	#4 1 -4	#5 -14 -8	#1 2 0	#6 -2 0
sp4 *0*	#1 15 -7	#2 3 5	#4 8 -12	#3 0 13	#5 -12 -13	#6 -5 -2
x+12 *0*	#4 -1 -18	#1 24 15	#5 29 -12	#2 48 -28	#3 10 -13	#6 -9 1
x+18 *0*	#4 -21 -6	#1 -4 9	#2 19 2	#5 30 0	#3 17 -19	#6 -11 0
y+12 *0*	#4 8 -1	#1 -7 -9	#3 10 -4	#5 -6 7	#2 12 -3	#6 -3 -38
y+06 *0*	#3 27 -13	#4 5 15	#1 10 -10	#5 5 0	#2 10 0	#6 5 -1
y-06 *0*	#1 -5 -6	#2 -19 -20	#4 -4 14	#6 0 1		

NBDL GIANT: 15:15 03/25/92
azimuth - elevation - swing

Page 6

TRIANGULATED		IMAGE POINTS			RESIDUALS	
		(in micrometers)				
z+06 *0*	#3 8 18	#5 -31 3	#1 12 7	#2 -4 -14	#4 -3 21	#6 -4 33
z+12 *0*	#2 -17 -21	#1 17 25	#4 -23 3	#6 -19 38		

NAVAL BIODYNAMICS LABORATORY SOFTWARE DOCUMENTATION

lfc2	#3	#5	#6	#2	#4
	-2	4	-2	23	-14
	-2	27	-30	-2	12
lfc5	#3	#5	#4	#2	
	5	2	-7	-1	
	-1	-7	8	1	
c8	#4	#2	#6	#3	#5
	-1	0	13	15	-10
	1	-3	0	5	-2
d	#4	#6	#3	#5	#2
	5	2	0	-27	-35
	-19	6	22	-18	15
e	#2	#3	#6	#5	#4
	-36	-4	3	-11	6
	25	0	37	-41	-15
rtc4 *0*	#5	#3	#2	#6	#4
	-11	5	0	2	7
	-12	-1	21	-3	-15
rtc8 *0*	#2				
	5				
	20				
x+06 *0*	#5	#3	#2	#4	#6
	-14	13	10	-16	-15
	-9	-14	-9	-19	0
x+24 *0*	#3	#6	#2	#4	
	-14	48	-33	24	
	40	0	23	41	
lfc8	#3	#6	#5		
	-17	-10	3		
	10	0	-7		
c	#5	#6	#4		
	17	-4	-1		
	9	12	-18		

NBDL GIANT: 15:15 03/25/92
azimuth - elevation - swing

Page 7

TRIANGULATED IMAGE POINTS RESIDUALS
(in micrometers)

y-12 *0*	#4	#6	#5
	9	-1	42
	32	-25	-6
g	#6	#5	
	-2	-2	

Anthropometry and Initial Conditions Photogrammetric Program

	-16	16
h	#6	#5
	-2	-2
	-19	17
i	#6	#5
	0	0
	-3	3

Weighted Sum of Squares (Camera) =	0.0
Weighted Sum of Squares (Object) =	107.0
Weighted Sum of Squares (Plates) =	206.4
Weighted Sum of Squares (Total) =	313.5
Degrees of Freedom..... =	286

a posteriori Variance of Unit Weight = 1.096

NBDL GIANT: 15:15 03/25/92
azimuth - elevation - swing

Page 8

T R I A N G U L A T E D C A M E R A S T A T I O N S (Terrestrial->Ph)

Ident	Position/Attitude	Covariance Matrix
#1	X = -0.4202 m.	+4.621E-06 -4.300E-07 +7.299E-07
	Y = -1.2981 m.	-4.300E-07 +3.703E-06 +3.339E-07
	Z = 0.9382 m.	+7.299E-07 +3.339E-07 +5.628E-06
	Azim. = 19 50 43.9750	+1.680E-06 -2.153E-07 -3.530E-07
	Elev. =- 28 07 18.6050	-2.153E-07 +1.680E-06 -3.530E-07
	Swing = 04 19 19.1519	-3.530E-07 -3.530E-07 +1.426E-06
#2	X = 0.9591 m.	+5.169E-06 +1.535E-06 -8.687E-07
	Y = -1.2663 m.	+1.535E-06 +4.188E-06 +6.254E-07
	Z = 0.9626 m.	-8.687E-07 +6.254E-07 +5.765E-06
	Azim. = 332 52 40.0853	+1.844E-06 +1.201E-08 -3.896E-07
	Elev. =- 29 29 36.4430	+1.201E-08 +1.844E-06 -3.896E-07
	Swing =- 01 57 52.1536	-3.896E-07 -3.896E-07 +1.152E-06
#3	X = 1.8605 m.	+4.568E-06 +1.157E-06 +1.433E-06
	Y = -0.3919 m.	+1.157E-06 +5.927E-06 +2.108E-07
	Z = 0.9121 m.	+1.433E-06 +2.108E-07 +1.063E-05
	Azim. = 299 35 47.0441	+1.616E-06 +2.794E-07 -7.710E-07
	Elev. =- 28 25 56.5311	+2.794E-07 +1.616E-06 -7.710E-07
	Swing = 00 54 35.2447	-7.710E-07 -7.710E-07 +3.511E-06
#4	X = 1.8857 m.	+5.353E-06 -2.966E-06 -1.193E-06
	Y = 1.1240 m.	-2.966E-06 +1.203E-05 +1.526E-06
	Z = 0.8633 m.	-1.193E-06 +1.526E-06 +1.123E-05
	Azim. = 246 54 29.5476	+2.624E-06 +4.737E-07 -1.147E-07
	Elev. =- 26 20 3.8353	+4.737E-07 +2.624E-06 -1.147E-07
	Swing =- 01 42 27.3195	-1.147E-07 -1.147E-07 +3.989E-06

NAVAL BIODYNAMICS LABORATORY SOFTWARE DOCUMENTATION

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#5      X =      1.0024 m.  +1.243E-05 -2.054E-06 +1.176E-06
        Y =      2.0435 m.  -2.054E-06 +6.210E-06 -9.771E-07
        Z =      0.8161 m.  +1.176E-06 -9.771E-07 +1.148E-05
Azim. = 202 03 15.2619 +2.350E-06 +2.642E-07 +3.948E-07
Elev. =- 26 10 27.3019 +2.642E-07 +2.350E-06 +3.948E-07
Swing =- 02 24  9.5880 +3.948E-07 +3.948E-07 +1.804E-06

#6      X =     -0.3616 m.  +6.813E-06 +7.454E-07 +5.804E-07
        Y =      2.0920 m.  +7.454E-07 +5.103E-06 -2.669E-07
        Z =      0.7872 m.  +5.804E-07 -2.669E-07 +8.967E-06
Azim. = 158 34 26.3098 +1.428E-06 +1.194E-07 +2.166E-07
Elev. =- 22 25 15.6254 +1.194E-07 +1.428E-06 +2.166E-07
Swing =- 00 11 47.8227 +2.166E-07 +2.166E-07 +1.300E-06
    
```

S U M M A R Y S T A T I S T I C S F O R C A M E R A S T A T I O N S

RMS For Standard Deviations

```

Count =   6      X =      0.0025 m.      Azim. = 00 04 46.0957
                  Y =      0.0025 m.      Elev.  = 00 06 10.0783
                  Z =      0.0030 m.      Swing = 00 05  5.7246
    
```

NBDL GIANT: 15:15 03/25/92
azimuth - elevation - swing

Page 9

T R I A N G U L A T E D O B J E C T P O I N T S

Ident	Position (meters)	Covariance Matrix	Std Dev (m)
a	X = 0.2977	+2.299E-07 +9.901E-09 +4.550E-08	0.0005
	Y = 0.0099	+9.901E-09 +2.498E-07 -3.700E-08	0.0005
	Z = -0.0707	+4.550E-08 -3.700E-08 +2.204E-07	0.0005
b	X = 0.2988	+2.460E-07 +1.038E-08 +5.062E-08	0.0005
	Y = 0.0088	+1.038E-08 +2.727E-07 -3.958E-08	0.0005
	Z = -0.1351	+5.062E-08 -3.958E-08 +2.423E-07	0.0005
c	X = 0.5555	+7.041E-07 +2.934E-07 +2.662E-07	0.0008
	Y = 0.0766	+2.934E-07 +1.328E-06 +5.841E-07	0.0012
	Z = -0.3266	+2.662E-07 +5.841E-07 +9.724E-07	0.0010
d	X = 0.2991	+8.934E-07 -3.066E-08 +1.136E-07	0.0009
	Y = 0.7227	-3.066E-08 +9.283E-07 +1.612E-07	0.0010
	Z = -0.1620	+1.136E-07 +1.612E-07 +9.815E-07	0.0010
e	X = 0.2996	+8.979E-07 -1.685E-08 +1.165E-07	0.0009
	Y = 0.7200	-1.685E-08 +9.408E-07 +1.944E-07	0.0010
	Z = -0.2236	+1.165E-07 +1.944E-07 +1.003E-06	0.0010
g	X = 0.0549	+2.085E-06 +8.680E-07 +4.311E-07	0.0014
	Y = -0.9181	+8.680E-07 +2.233E-05 +6.122E-06	0.0047
	Z = -0.2093	+4.311E-07 +6.122E-06 +4.159E-06	0.0020
h	X = 0.6597	+2.644E-06 -2.287E-06 -2.968E-07	0.0016
	Y = -1.0184	-2.287E-06 +2.439E-05 +5.651E-06	0.0049
	Z = -0.0603	-2.968E-07 +5.651E-06 +4.248E-06	0.0021

Anthropometry and Initial Conditions Photogrammetric Program

i	X =	0.8362	+3.492E-06	-4.007E-06	-1.737E-06	0.0019
	Y =	-0.6713	-4.007E-06	+2.451E-05	+1.099E-05	0.0050
	Z =	-0.7043	-1.737E-06	+1.099E-05	+8.327E-06	0.0029
c1	X =	0.0701	+6.973E-07	-1.521E-08	+5.814E-08	0.0008
	Y =	0.6693	-1.521E-08	+7.332E-07	+2.923E-08	0.0009
	Z =	0.0204	+5.814E-08	+2.923E-08	+7.703E-07	0.0009
c2	X =	0.0197	+6.996E-07	+1.284E-08	+5.225E-08	0.0008
	Y =	0.6681	+1.284E-08	+7.990E-07	+4.640E-08	0.0009
	Z =	0.0200	+5.225E-08	+4.640E-08	+7.899E-07	0.0009
c3	X =	0.0181	+7.698E-07	-1.455E-08	+5.823E-08	0.0009
	Y =	0.7182	-1.455E-08	+7.890E-07	+3.849E-08	0.0009
	Z =	0.0163	+5.823E-08	+3.849E-08	+8.665E-07	0.0009
c4	X =	0.0682	+7.794E-07	-2.070E-08	+6.250E-08	0.0009
	Y =	0.7196	-2.070E-08	+8.027E-07	+3.957E-08	0.0009
	Z =	0.0166	+6.250E-08	+3.957E-08	+8.691E-07	0.0009
c5	X =	0.0706	+7.813E-07	+9.717E-09	+9.401E-08	0.0009
	Y =	0.6656	+9.717E-09	+7.551E-07	+3.135E-08	0.0009
	Z =	-0.0303	+9.401E-08	+3.135E-08	+8.187E-07	0.0009

NBDL GIANT: 15:15 03/25/92
azimuth - elevation - swing

Page 10

TRIANGULATED OBJECT POINTS

Ident		Position (meters)	Covariance Matrix				Std Dev (m)
c7	X =	0.0190	+8.134E-07	+5.276E-08	+7.591E-08	0.0009	
	Y =	0.7157	+5.276E-08	+9.010E-07	+1.313E-07	0.0009	
	Z =	-0.0337	+7.591E-08	+1.313E-07	+9.307E-07	0.0010	
c8	X =	0.0688	+8.108E-07	-1.775E-08	+7.721E-08	0.0009	
	Y =	0.7164	-1.775E-08	+8.125E-07	+9.019E-08	0.0009	
	Z =	-0.0336	+7.721E-08	+9.019E-08	+8.989E-07	0.0009	
sp1	*0*	X =	0.0252	+1.039E-07	+6.685E-10	+9.451E-09	0.0003
		Y =	-0.0252	+6.685E-10	+1.210E-07	-9.075E-09	0.0003
		Z =	0.0259	+9.451E-09	-9.075E-09	+9.794E-08	0.0003
sp2	*0*	X =	-0.0256	+1.060E-07	+2.951E-10	+9.440E-09	0.0003
		Y =	-0.0250	+2.951E-10	+1.239E-07	-9.308E-09	0.0004
		Z =	0.0256	+9.440E-09	-9.308E-09	+1.007E-07	0.0003
sp3	*0*	X =	-0.0255	+1.061E-07	+2.216E-10	+9.460E-09	0.0003
		Y =	0.0254	+2.216E-10	+1.253E-07	-8.661E-09	0.0004
		Z =	0.0255	+9.460E-09	-8.661E-09	+9.997E-08	0.0003
sp4	*0*	X =	0.0249	+1.039E-07	+4.784E-10	+9.529E-09	0.0003
		Y =	0.0253	+4.784E-10	+1.224E-07	-8.430E-09	0.0003
		Z =	0.0256	+9.529E-09	-8.430E-09	+9.729E-08	0.0003
lfc1	X =	0.0653	+9.585E-07	-3.486E-08	+7.054E-08	0.0010	
	Y =	0.8193	-3.486E-08	+9.462E-07	+6.130E-08	0.0010	

NAVAL BIODYNAMICS LABORATORY SOFTWARE DOCUMENTATION

	Z =	0.0114	+7.054E-08	+6.130E-08	+1.086E-06	0.0010
lfc2	X =	0.0152	+9.840E-07	-2.798E-08	+7.667E-08	0.0010
	Y =	0.8187	-2.798E-08	+9.445E-07	+7.842E-08	0.0010
	Z =	0.0111	+7.667E-08	+7.842E-08	+1.113E-06	0.0011
lfc3	X =	0.0145	+1.044E-06	-3.305E-08	+6.874E-08	0.0010
	Y =	0.8687	-3.305E-08	+1.002E-06	+7.181E-08	0.0010
	Z =	0.0085	+6.874E-08	+7.181E-08	+1.205E-06	0.0011
lfc4	X =	0.0646	+1.144E-06	-1.906E-08	+1.163E-07	0.0011
	Y =	0.8699	-1.906E-08	+1.056E-06	+5.492E-08	0.0010
	Z =	0.0088	+1.163E-07	+5.492E-08	+1.261E-06	0.0011
lfc5	X =	0.0662	+1.159E-06	+5.931E-09	+1.777E-07	0.0011
	Y =	0.8170	+5.931E-09	+9.900E-07	+9.966E-08	0.0010
	Z =	-0.0394	+1.777E-07	+9.966E-08	+1.205E-06	0.0011
lfc6	X =	0.0156	+1.060E-06	-1.282E-07	+1.681E-08	0.0010
	Y =	0.8152	-1.282E-07	+1.310E-06	+1.468E-07	0.0011
	Z =	-0.0391	+1.681E-08	+1.468E-07	+1.219E-06	0.0011
lfc8	X =	0.0648	+1.120E-06	-2.761E-08	+7.216E-08	0.0011
	Y =	0.8673	-2.761E-08	+1.225E-06	+2.379E-07	0.0011
	Z =	-0.0411	+7.216E-08	+2.379E-07	+1.356E-06	0.0012

NBDL GIANT: 15:15 03/25/92
azimuth - elevation - swing

Page 11

TRIANGULATED OBJECT POINTS

Ident		Position (meters)	Covariance Matrix			Std Dev (m)	
rtc1	*0*	X =	0.0252	+1.185E-07	+2.364E-09	+1.289E-08	0.0003
		Y =	-0.0249	+2.364E-09	+1.258E-07	-1.547E-08	0.0004
		Z =	-0.0250	+1.289E-08	-1.547E-08	+1.123E-07	0.0003
rtc2	*0*	X =	-0.0247	+1.204E-07	-1.159E-08	+9.750E-09	0.0003
		Y =	-0.0250	-1.159E-08	+1.464E-07	-2.257E-08	0.0004
		Z =	-0.0261	+9.750E-09	-2.257E-08	+1.243E-07	0.0004
rtc3	*0*	X =	-0.0252	+1.269E-07	+1.950E-08	+1.351E-09	0.0004
		Y =	0.0251	+1.950E-08	+1.742E-07	-1.537E-09	0.0004
		Z =	-0.0255	+1.351E-09	-1.537E-09	+1.269E-07	0.0004
rtc4	*0*	X =	0.0253	+1.318E-07	-4.612E-09	+1.911E-08	0.0004
		Y =	0.0250	-4.612E-09	+1.357E-07	+1.511E-09	0.0004
		Z =	-0.0253	+1.911E-08	+1.511E-09	+1.163E-07	0.0003
rtc6	*0*	X =	-0.0246	+1.454E-07	-7.271E-09	+5.408E-09	0.0004
		Y =	-0.0254	-7.271E-09	+1.950E-07	-4.951E-08	0.0004
		Z =	-0.0767	+5.408E-09	-4.951E-08	+1.741E-07	0.0004
rtc7	*0*	X =	-0.0246	+1.795E-07	+1.749E-08	-1.396E-08	0.0004
		Y =	0.0256	+1.749E-08	+2.335E-07	-4.602E-08	0.0005
		Z =	-0.0756	-1.396E-08	-4.602E-08	+2.085E-07	0.0005

Anthropometry and Initial Conditions Photogrammetric Program

rtc8	*0*	X =	0.0254	+2.063E-07	-2.994E-08	+2.360E-08	0.0005
		Y =	0.0252	-2.994E-08	+2.257E-07	-3.314E-08	0.0005
		Z =	-0.0765	+2.360E-08	-3.314E-08	+2.116E-07	0.0005
x+06	*0*	X =	0.1513	+1.271E-07	-5.154E-09	+1.909E-08	0.0004
		Y =	0.0000	-5.154E-09	+1.306E-07	-3.167E-10	0.0004
		Z =	0.0008	+1.909E-08	-3.167E-10	+1.126E-07	0.0003
x+12	*0*	X =	0.3033	+1.137E-07	+8.661E-10	+9.999E-09	0.0003
		Y =	-0.0005	+8.661E-10	+1.262E-07	-7.340E-09	0.0004
		Z =	0.0009	+9.999E-09	-7.340E-09	+1.101E-07	0.0003
x+18	*0*	X =	0.4566	+1.351E-07	+3.873E-10	+9.812E-09	0.0004
		Y =	-0.0005	+3.873E-10	+1.464E-07	-7.028E-09	0.0004
		Z =	0.0003	+9.812E-09	-7.028E-09	+1.365E-07	0.0004
x+24	*0*	X =	0.6075	+1.788E-07	-4.605E-09	+1.159E-08	0.0004
		Y =	0.0000	-4.605E-09	+1.882E-07	-5.868E-09	0.0004
		Z =	-0.0017	+1.159E-08	-5.868E-09	+1.825E-07	0.0004
y+06	*0*	X =	-0.0003	+1.172E-07	+6.907E-10	+8.754E-09	0.0003
		Y =	0.1520	+6.907E-10	+1.351E-07	-5.050E-09	0.0004
		Z =	0.0002	+8.754E-09	-5.050E-09	+1.132E-07	0.0003
y+12	*0*	X =	-0.0001	+1.517E-07	+1.086E-09	+6.269E-09	0.0004
		Y =	0.3043	+1.086E-09	+1.610E-07	-6.024E-10	0.0004
		Z =	0.0008	+6.269E-09	-6.024E-10	+1.571E-07	0.0004

NBDL GIANT: 15:15 03/25/92
azimuth - elevation - swing

Page 12

T R I A N G U L A T E D O B J E C T P O I N T S

Ident		Position (meters)	Covariance Matrix				Std Dev (m)
y-06	*0*	X =	0.0004	+1.245E-07	-5.917E-10	+4.709E-09	0.0004
		Y =	-0.1518	-5.917E-10	+1.532E-07	-1.987E-08	0.0004
		Z =	0.0002	+4.709E-09	-1.987E-08	+1.351E-07	0.0004
y-12	*0*	X =	0.0007	+1.926E-07	+1.749E-08	+9.474E-09	0.0004
		Y =	-0.3052	+1.749E-08	+2.329E-07	+1.667E-08	0.0005
		Z =	0.0000	+9.474E-09	+1.667E-08	+1.929E-07	0.0004
z+06	*0*	X =	-0.0007	+1.086E-07	+9.350E-10	+8.399E-09	0.0003
		Y =	0.0004	+9.350E-10	+1.323E-07	-7.803E-09	0.0004
		Z =	0.1513	+8.399E-09	-7.803E-09	+9.708E-08	0.0003
z+12	*0*	X =	-0.0007	+1.390E-07	+1.416E-09	+5.661E-09	0.0004
		Y =	0.0006	+1.416E-09	+1.869E-07	-1.030E-08	0.0004
		Z =	0.3039	+5.661E-09	-1.030E-08	+1.253E-07	0.0004

S U M M A R Y S T A T I S T I C S F O R O B J E C T P O I N T S

RMS For Standard Deviations

Count = 22	X =	0.0010 meters
Count = 22	Y =	0.0020 meters

NAVAL BIODYNAMICS LABORATORY SOFTWARE DOCUMENTATION

Count = 22 Z = 0.0013 meters

NBDL GIANT: 15:15 03/25/92
azimuth - elevation - swing

Page 13

C O R R E C T I O N S A P P L I E D T O O B J E C T C O N T R O L

	X =	-0.0002 m		X =	-0.0002 m
rtc1	Y =	0.0005 m	sp1	Y =	0.0002 m
	Z =	0.0004 m		Z =	0.0005 m
	X =	-0.0015 m		X =	-0.0001 m
x+12	Y =	-0.0005 m	y+12	Y =	-0.0005 m
	Z =	0.0009 m		Z =	0.0008 m
	X =	-0.0007 m		X =	0.0007 m
z+12	Y =	0.0006 m	y-12	Y =	-0.0004 m
	Z =	-0.0009 m		Z =	0.0000 m
	X =	0.0007 m		X =	-0.0002 m
rtc2	Y =	0.0004 m	sp2	Y =	0.0004 m
	Z =	-0.0007 m		Z =	0.0002 m
	X =	0.0002 m		X =	-0.0001 m
rtc3	Y =	-0.0003 m	sp3	Y =	0.0000 m
	Z =	-0.0001 m		Z =	0.0001 m
	X =	0.0027 m		X =	-0.0001 m
x+24	Y =	0.0000 m	rtc4	Y =	-0.0004 m
	Z =	-0.0017 m		Z =	0.0001 m
	X =	-0.0005 m		X =	-0.0011 m
sp4	Y =	-0.0001 m	x+06	Y =	0.0000 m
	Z =	0.0002 m		Z =	0.0008 m
	X =	-0.0003 m		X =	-0.0007 m
y+06	Y =	-0.0004 m	z+06	Y =	0.0004 m
	Z =	0.0002 m		Z =	-0.0011 m
	X =	0.0004 m		X =	0.0008 m
y-06	Y =	0.0006 m	rtc6	Y =	0.0000 m
	Z =	0.0002 m		Z =	-0.0005 m
	X =	0.0008 m		X =	-0.0006 m
rtc7	Y =	0.0002 m	x+18	Y =	-0.0005 m
	Z =	0.0006 m		Z =	0.0003 m
	X =	0.0000 m			
rtc8	Y =	-0.0002 m			
	Z =	-0.0003 m			

X	Number of Components =	21	RMS =	0.0008 meters
Y	Number of Components =	21	RMS =	0.0004 meters
Z	Number of Components =	21	RMS =	0.0006 meters

Appendix C Program Listings

XPREP Program Listing

F77L - Lahey FORTRAN 77, Version 5.01 20 Apr 93 14:51:12
PROGRAM XPREP Compiling Options:
/NO/N2/N3/N7/NA/A1/NA2/NB/NC/C1/ND/NE/NF/H/I/NK/NL/P/NQ1/R/S/NT/NV/W/NX/NZ1
Source file Listing

Page 1

```
1 PROGRAM XPREP
2 WRITE (*,*) ' Enter 1 for HEAD digitization '
3 WRITE (*,*) ' Enter 2 for BODY digitization '
4 READ (*,*) I
5 IF(I.EQ.1)CALL HEAD
6 IF(I.EQ.2)CALL BODY
7 END
```

F77L - Lahey FORTRAN 77, Version 5.01 20 Apr 93 14:51:12
SUBROUTINE HEAD Compiling Options:
/NO/N2/N3/N7/NA/A1/NA2/NB/NC/C1/ND/NE/NF/H/I/NK/NL/P/NQ1/R/S/NT/NV/W/NX/NZ1
Source file Listing

Page 2

```
8
9 SUBROUTINE HEAD
10 IMPLICIT DOUBLE PRECISION (A-H,O-Z)
11 CHARACTER DATA*17, fn1*12, fn2*12, fn3*12, fn4*12
12 CHARACTER*8 IFRAM(6),IDCAL(2,19),IDHED(19), IDPT, DAY
13 CHARACTER JTITLE*42
14 COMMON /TITLE/ JTITLE, I Page
15 INTEGER IDFD(10), IBUTT,IFID,IRED,IX,IY
16 REAL*8 XY(2,21,3), CALFID(2,10,2)
17 logical iflag
18 EXTERNAL SYSTEM
19 INTRINSIC CHAR,DFLOAT, DSIN, DCOS, DSQRT
20 COMMON CALCOR(2,50),OBSCOR(2,50),EQN(8,9),DEL(8),ICH3, NFID
21 DATA IFRAM /'A/Pprism','LATprism',
22 'A/Phrv90','LAThrv90','A/Phrv45','LAThrv45'/
23 DATA IDCAL /'c3','c5',2*'c13','c4','c8',2*'c11',2*'c10',2*'c9',
24 'c2','c6',2*'c12','c1','c7',2*'cv1',2*'cv2',2*'cv3',
25 2*'cv4',2*'cv5',2*'cv6',2*'cv7',2*'cv8',2*'cv9',2*'cv10'/
26 DATA IDHED /'lam','ram','lon','ron','ltp','rtp','ctp','chin',
27 'ltuskF','ltuskM','ltuskR','rtuskF','rtuskM','rtuskR',
28 'capLfF','capLFR','capRtF','capRtR','capCEN'/
29 DATA CALFID/-147.150, 190.190,-160.380, 77.030,-158.830, -77.220,
30 -146.442,-192.510, 5.760, 190.060, 5.990,-191.570,
31 157.980, 190.490, 146.070, 75.380, 147.920, -77.730,
32 158.540,-191.520,-148.160, 193.950,-162.380, 80.380,
33 -164.310, -75.670,-148.961,-191.214, 5.010, 193.920,
34 4.800,-192.310, 159.210, 193.010, 147.600, 80.050,
35 144.880, -75.390, 158.520,-192.720/
36 C .....
37 C ALTEK DIGITIZER 4-BUTTON KEY CONTROL MEANINGS:
38 C #2:RED=ERROR-BACKUP
39 C #4:BLUE=??? #1:YELLOW=MISSING
40 C #3:GREEN=FIDUCIAL or DATA POINT
41 C .....
42 NHED=19
```

NAVAL BIODYNAMICS LABORATORY SOFTWARE DOCUMENTATION

```

43      I      Page=0
44      WRITE (*,*) ' Enter COMM Port number: '
45      READ (*,*) Icmn
46      icmn=icmn+48
47      CALL SYSTEM ('MODE COM'//char(icmn)//':9600,0,7,2')
48      OPEN (11,FILE='COM'//char(icmn), ACCESS='TRANSPARENT')
49  C
50      WRITE (*,*) ' Enter HRV number: '
51      READ (*,*) IHRV
52      WRITE (*,*)
53      WRITE (FN1, '(14.4, ''HEAD.OUT'')')IHRV
54      WRITE (FN2, '(14.4, ''head.132'')')IHRV
55      WRITE (FN3, '(14.4, ''hing.dat'')')IHRV
56      WRITE (FN4, '(14.4, ''head.in'')')IHRV

```

F77L - Lahey FORTRAN 77, Version 5.01 20 Apr 93 14:51:12

Page 3

SUBROUTINE HEAD Compiling Options:

/NO/N2/N3/N7/NA/A1/NA2/NB/NC/C1/ND/NE/NF/H/1/NK/NL/P/NQ1/R/S/NT/NV/W/NX/NZ1

Source file Listing

```

57      OPEN ( 8,FILE =FN2)
58      OPEN ( 9,FILE =FN3)
59      OPEN (10,FILE =FN1)
60      OPEN (12,FILE =FN4)
61      CALL DATE (DAY)
62      WRITE (JTITLE,
63      .('' HRV # '' ,15.5, ''      Date: '' ,A8, ''      HEAD  '')) IHRV, DAY
64  C Read order of transformation
65      WRITE (*,*) ' Enter number of parameters for shrinkage fit: '
66      READ (*,*) IOPT1
67      WRITE (*,*)
68      units=25.4d-3
69      SDX = .75
70      SDY = .75
71      IF (IOPT1.GT.6)IOPT1=8
72      ICH3S=0
73      IF (IOPT1.LE.3) THEN
74          ICH3S=1
75          IOPT1=3
76      END IF
77  C      IOPT3=0
78  C NRED indicates the number of replications of plate coordinates
79      NRED=1
80  C
81  1  WRITE (*,*) ' Enter 0 when finished'
82      WRITE (*,*) ' Enter 1 if: A/P / CALIBRATION PRISM'
83      WRITE (*,*) ' Enter 2 if: LAT / CALIBRATION PRISM'
84      WRITE (*,*) ' Enter 3 if: A/P / HRV / 90 deg'
85      WRITE (*,*) ' Enter 4 if: LAT / HRV / 90 deg'
86      WRITE (*,*) ' Enter 5 if: A/P / HRV / 45 deg'
87      WRITE (*,*) ' Enter 6 if: LAT / HRV / 45 deg'
88      WRITE (*,*)
89      READ (*,*) IANS
90      if(ians.eq.0) go to 999
91  C
92  C Input data for the Preprocessing Program:
93  C      3, 4, 5, 6, 8 in col. 1 Three(etc)-parameter transformation
94  C
95  C      Calibrated Fiducial Coordinates in      FORMAT (2X,I4,4X,2F10.4)
96  C
97  C      Radial Lens Distortion Function:
98  C          Coefficients FK0, FK1      FORMAT (2D20.10)
99  C          Coefficients FK2, FK3      FORMAT (2D20.10)
100 C

```

Anthropometry and Initial Conditions Photogrammetric Program

```

101      CALL CLEAR
102  C
103      FOCAL= -889.D0
104      IF (MOD(IANS,2).EQ.1) FOCAL= -1820.D0
105      CALL NEWPAG

```

F77L - Lahey FORTRAN 77, Version 5.01 20 Apr 93 14:51:12

Page 4

SUBROUTINE HEAD Compiling Options:

/NO/N2/N3/N7/NA/A1/NA2/NB/NC/C1/ND/NE/NF/H/I/NK/NL/P/NQ1/R/S/NT/NV/W/NX/NZ1

Source file Listing

```

106      WRITE (8,1400) IFRAM(IANS)
107      WRITE (10,2400)IFRAM(IANS)
108      write (12, '(i1, 9x, 3f10.3)')iopt1, focal, sdx, sdy
109  C
110  C Write Calibrated Fiducial Coordinates
111  C
112      JFID=2-MOD(IANS,2)
113      do 8 ifid=1, 10
114      WRITE ( 8,1420) IFID,CALFID(1,IFID,JFID),CALFID(2,IFID,JFID)
115      WRITE (10,2420) IFID,CALFID(1,IFID,JFID),CALFID(2,IFID,JFID)
116  8   WRITE (12,1410) IFID,CALFID(1,IFID,JFID),CALFID(2,IFID,JFID)
117      write (12, '(/)')
118  C
119  C Read & Write Frame ID
120  C
121      WRITE ( 9,1516) IFRAM(IANS), FOCAL, SDX, SDY
122      WRITE (12,'(A8)') IFRAM(IANS)
123      CALL NEWPAG
124      WRITE ( 8,1380) IFRAM(IANS)
125      WRITE (10,2380) IFRAM(IANS)
126      NRED=1
127  C*****
128  C Start major loop for digitizing x-rays:
129      iflag=.true.
130      DO 40 IRED=1,NRED
131      IFID=1
132  10   READ (11) DATA
133      WRITE (*,*) CHAR(7)
134  C
135  C DECODE data from CHARACTER to INTEGER
136  C
137      if (ichar ( data(1:1) ) < 32) data(1:16) = data(2:17)
138      READ (DATA, 20) IBUTT,IX,IY
139  20   FORMAT (I1,1X,I6,1X,I6)
140  C
141  C Interpret action to take based on which button was pressed:
142      IF (IBUTT .EQ. 3) THEN
143          XY(1,IFID,IRED)=IX*units
144          XY(2,IFID,IRED)=IY*units
145          WRITE (*,30) 'FIDUCIAL',IFID,XY(1,IFID,IRED),XY(2,IFID,IRED)
146  30   FORMAT (' ',A,1X,I3,2X,F8.4,2X,F8.4)
147          if(iflag)then
148              isavex=ix
149              isavey=iy
150              iflag=.false.
151          endif
152          IFID=IFID+1
153      ELSEIF (IBUTT .EQ. 2) THEN
154          IFID=IFID-1

```

NAVAL BIODYNAMICS LABORATORY SOFTWARE DOCUMENTATION

F77L - Lahey FORTRAN 77, Version 5.01 20 Apr 93 14:51:12

Page 5

SUBROUTINE HEAD Compiling Options:

/NO/N2/N3/N7/NA/A1/NA2/NB/NC/C1/ND/NE/NF/H/I/NK/NL/P/NQ1/R/S/NT/NV/W/NX/NZ1

Source file Listing

```

155      WRITE (*,*) 'Backing up one to FIDUCIAL # ',IFID
156      WRITE (*,*) CHAR(7),CHAR(7)
157      ELSEIF (IBUTT .EQ. 1) THEN
158      XY(1,IFID,IRED)=-1.
159      XY(2,IFID,IRED)=-1.
160      WRITE (*,*) 'MISSING ', IFID
161      IFID=IFID+1
162      ELSE
163      WRITE (*,*) 'Not an option. Redo'
164      ENDIF
165      IF (IFID .LE. 10) GO TO 10
166  40  CONTINUE
167  C
168  C Write out the raw data to raw.dat
169      DO 60 IFID=1,10
170      IF (XY(1,IFID,1).GT.0) WRITE (12,50) IFID,( XY(1,IFID,IRED),
171      XY(2,IFID,IRED),IRED=1,NRED)
172  50  FORMAT (6X,14,S,6F10.3)
173  60  CONTINUE
174      WRITE (12,*)
175  C
176      IFID=0
177      DO 200 K=1,10
178  C
179  C Read measured fiducial coordinates
180  C
181      IFID=IFID+1
182  80  IF (IFID.GT.10) GO TO 210
183      IF (XY(1,IFID,1).LE.0) then
184      IFID=IFID+1
185      GO TO 80
186      ENDIF
187      KK=IFID
188      XMAX=0.0D0
189      YMAX=0.0D0
190      XMIN=1000.0D0
191      YMIN=1000.0D0
192      SUMX=0.0D0
193      SUMY=0.0D0
194      DO 100 J=1,NRED
195      X=XY(1,IFID,J)
196      Y=XY(2,IFID,J)
197      IF (X.EQ.0.AND.Y.EQ.0) GO TO 110
198      SUMX=SUMX+X
199      SUMY=SUMY+Y
200      IF (NRED.EQ.1) GO TO 100
201      IF (XMAX.LT.X) XMAX=X
202      IF (XMIN.GT.X) XMIN=X
203      IF (YMAX.LT.Y) YMAX=Y

```

F77L - Lahey FORTRAN 77, Version 5.01 20 Apr 93 14:51:12

Page 6

SUBROUTINE HEAD Compiling Options:

/NO/N2/N3/N7/NA/A1/NA2/NB/NC/C1/ND/NE/NF/H/I/NK/NL/P/NQ1/R/S/NT/NV/W/NX/NZ1

Source file Listing

```

204      IF (YMIN.GT.Y) YMIN=Y
205  100  CONTINUE
206      IF (NRED.NE.1) GO TO 120
207  110  XMIN=0.0D0

```

Anthropometry and Initial Conditions Photogrammetric Program

```

208      YMIN=0.0D0
209      J=NRED
210      IF (J.EQ.0) J=1
211      XT=SUMX/J
212      YT=SUMY/J
213 C    Store averaged digitized coordinates
214      OBSCOR(1,K)=XT
215      OBSCOR(2,K)=YT
216      CALCOR(1,K)=CALFID(1,KK,JFID)
217      CALCOR(2,K)=CALFID(2,KK,JFID)
218      IDFD(K)=KK
219      WRITE ( 8,1540) KK,XT,YT,XMAX-XMIN,YMAX-YMIN
220      WRITE (10,2540) KK,XT,YT,XMAX-XMIN,YMAX-YMIN
221      200 CONTINUE
222 C
223 C    Compute the 3-Parameter Check Transformation.
224 C
225      210 NFID=K-1
226      ICH3S=1
227      CALL FOURP
228      WRITE (*,*)' 3-Parameter Check Transformation'
229      rmsx=0.
230      rmsy=0.
231      DO 220 I=1,NFID
232          X=OBSCOR(1,I)
233          Y=OBSCOR(2,I)
234          XT=(X*DEL(1)+Y*DEL(2)+DEL(3))/(X*DEL(4)+Y*DEL(5)+1.0)-CALCOR(1,I)
235          YT=(X*DEL(6)+Y*DEL(7)+DEL(8))/(X*DEL(4)+Y*DEL(5)+1.0)-CALCOR(2,I)
236          KK=IDFD(I)
237          WRITE ( *,2560) KK,XT,YT
238          rmsx=rmsx+xt*xt
239          rmsy=rmsy+yt*yt
240      220 CONTINUE
241      rmsx3=dsqrt(rmsx/nfid)
242      rmsy3=dsqrt(rmsy/nfid)
243      write (*,230)rmsx, rmsy
244      230 format (' rms= ',2f7.3)
245      WRITE (*,*)
246      WRITE (*,*)iopt1,'-Parameter Transformation'
247      rmsx=0.
248      rmsy=0.
249 C
250 C    Compute the Multi-Parameter Transformation.
251      ICH3=ICH3S
252      IF (IOPT1.LE.5) CALL FOURP

```

F77L - Lahey FORTRAN 77, Version 5.01 20 Apr 93 14:51:12

Page 7

SUBROUTINE HEAD Compiling Options:

/NO/N2/N3/N7/NA/A1/NA2/NB/NC/C1/ND/NE/NF/H/I/NK/NL/P/NQ1/R/S/NT/NV/W/NX/NZ1

Source file Listing

```

253      IF (IOPT1.EQ.5) CALL FIVEP
254      IF (IOPT1.EQ.6) CALL SIXP
255      IF (IOPT1.EQ.8) CALL EIGHTP
256      WRITE ( 8,1550) IOPT1
257      WRITE (10,2550) IOPT1
258 C
259 C    Compute Residuals For the Fiducial Coordinates
260 C
261      DO 240 I=1,NFID
262          X=OBSCOR(1,I)
263          Y=OBSCOR(2,I)
264          XT=(X*DEL(1)+Y*DEL(2)+DEL(3))/(X*DEL(4)+Y*DEL(5)+1.0)-CALCOR(1,I)
265          YT=(X*DEL(6)+Y*DEL(7)+DEL(8))/(X*DEL(4)+Y*DEL(5)+1.0)-CALCOR(2,I)

```

NAVAL BIODYNAMICS LABORATORY SOFTWARE DOCUMENTATION

```

266      KK=IDFD(1)
267      WRITE ( 8,1560) KK,XT,YT
268      WRITE (10,2560) KK,XT,YT
269      WRITE ( *,2560) KK,XT,YT
270      rmsx=rmsx+xt*xt
271      rmsy=rmsy+yt*yt
272      240 CONTINUE
273      rmsx=dsqrt(rmsx/nfid)
274      rmsy=dsqrt(rmsy/nfid)
275      write (*,230)rmsx, rmsy
276      write( 8, 1545)rmsx, rmsy, rmsx3, rmsy3, del
277      write(10, 2545)rmsx, rmsy, rmsx3, rmsy3, del
278      1545 FORMAT(/43X,'RMS',2F15.3/43X,'RMS(CHECK)',F8.3, F15.3/
279      .      /45X,'TRANSFORMATION PARAMETERS ARE: '/33X,2F11.6,F11.4,
280      .      2F11.6/33X,2F11.6,F11.4//)
281      2545 FORMAT(/23X,'Rms',2F15.3/23X,'Rms(check)',F8.3, F15.3/
282      .      /25X,'Transformation Parameters Are: '/13X,2F11.6,F11.4,
283      .      2F11.6/13X,2F11.6,F11.4)
284      CALL NEWPAG
285      IF (NRED .GT. 1) WRITE (8,1570) IFRAM(1ANS)
286      IF (NRED .GT. 1) WRITE (10,2570)IFRAM(1ANS)
287      IF (NRED .EQ. 1) WRITE (8,1575) IFRAM(1ANS)
288      IF (NRED .EQ. 1) WRITE (10,2575)IFRAM(1ANS)
289      PAUSE
290      C*****
291      IF (1ANS.GE.3) GO TO 500
292      C Compute the Averaged Coordinates of the Calibration Prism
293      C
294      C1250 READ ( 7,1580) IDPT,((TEMPM1(I,J),I=1,2),J=1,NRED)
295      DO 260 IRED=1,NRED
296      ICAL=1
297      250 READ (11) DATA
298      WRITE (*,*) CHAR(7)
299      C
300      C DECODE data from CHARACTER to INTEGER
301      C
302      if (ichar ( data(1:1) ) < 32) data(1:16) = data(2:17)

```

F77L - Lahey FORTRAN 77, Version 5.01 20 Apr 93 14:51:12

Page 8

SUBROUTINE HEAD Compiling Options:

/NO/N2/N3/N7/NA/A1/NA2/NB/NC/C1/ND/NE/NF/H/I/NK/NL/P/NQ1/R/S/NT/NV/W/NX/NZ1

Source file Listing

```

303      READ (DATA, 20) IBUTT,IX,IY
304      C
305      C Interpret action to take based on which button was pressed:
306      IF (IBUTT .EQ. 3) THEN
307      XY(1,ICAL,IRED)=IX*units
308      XY(2,ICAL,IRED)=IY*units
309      WRITE (*,30)'CAL. PT.',ICAL,XY(1,ICAL,IRED),XY(2,ICAL,IRED)
310      ICAL=ICAL+1
311      ELSEIF (IBUTT .EQ. 2) THEN
312      ICAL=ICAL-1
313      WRITE (*,*) 'Backing up one to CAL. PT. # ',ICAL
314      WRITE (*,*) CHAR(7),CHAR(7)
315      ELSEIF (IBUTT .EQ. 1) THEN
316      XY(1,ICAL,IRED)=-1.
317      XY(2,ICAL,IRED)=-1.
318      WRITE (*,*) 'MISSING ', ICAL
319      ICAL=ICAL+1
320      ELSE
321      WRITE (*,*) 'Not an option. Redo'
322      ENDIF
323      IF (ICAL .LE. 19) GO TO 250

```


Anthropometry and Initial Conditions Photogrammetric Program

```

324 260 CONTINUE
325 C
326 DO 280 ICAL=1,19
327 IF (XY(1,ICAL,1).GT.0) WRITE (12,270) IDCAL(IANS,ICAL),
328 (XY(1,ICAL,IRED),XY(2,ICAL,IRED),IRED=1,NRED)
329 270 FORMAT (2X,AB,1X,S,6(F9.4,1X))
330 280 CONTINUE
331 WRITE (12,*)
332 C
333 ICAL=0
334 DO 390 K=1,19
335 C
336 C Process measured calibration prism coordinates
337 C
338 ICAL=ICAL+1
339 290 IF (ICAL.GT.19) GO TO 400
340 IF (XY(1,ICAL,1).LE.0) then
341 ICAL=ICAL+1
342 GO TO 290
343 ENDIF
344 KK=ICAL
345 XMAX=0.0D0
346 YMAX=0.0D0
347 XMIN=1000.0D0
348 YMIN=1000.0D0
349 SUMX=0.0D0
350 SUMY=0.0D0
351 DO 300 J=1,NRED

```

F77L - Lahey FORTRAN 77, Version 5.01 20 Apr 93 14:51:12

Page 9

SUBROUTINE HEAD Compiling Options:

/NO/N2/N3/N7/NA/A1/NA2/NB/NC/C1/ND/NE/NF/H/I/NK/NL/P/NQ1/R/S/NT/NV/W/NX/NZ1

Source file Listing

```

352 X=XY(1,ICAL,J)
353 Y=XY(2,ICAL,J)
354 IF (X.EQ.0.AND.Y.EQ.0) GO TO 310
355 SUMX=SUMX+X
356 SUMY=SUMY+Y
357 IF (NRED.EQ.1) GO TO 300
358 IF (XMAX.LT.X) XMAX=X
359 IF (XMIN.GT.X) XMIN=X
360 IF (YMAX.LT.Y) YMAX=Y
361 IF (YMIN.GT.Y) YMIN=Y
362 300 CONTINUE
363 IF (NRED.NE.1) GO TO 320
364 310 XMIN=0.0D0
365 YMIN=0.0D0
366 320 J=NRED
367 IF (J.EQ.0) J=1
368 X=SUMX/J
369 Y=SUMY/J
370 XM=XMAX-XMIN
371 YM=YMAX-YMIN
372 IDPT=IDCAL(IANS,KK)
373 C
374 C Correct Measured Coordinates for Film Shrinkage
375 C
376 XT=(X*DEL(1)+Y*DEL(2)+DEL(3))/(X*DEL(4)+Y*DEL(5)+1.0)
377 YT=(X*DEL(6)+Y*DEL(7)+DEL(8))/(X*DEL(4)+Y*DEL(5)+1.0)
378 C
379 IF (NRED .GT. 1) WRITE ( 8,1600) IDPT,X,Y,XT,YT,XM,YM
380 IF (NRED .GT. 1) WRITE (10,2600) IDPT,X,Y,XT,YT,XM,YM
381 IF (NRED .EQ. 1) WRITE ( 8,1605) IDPT,X,Y,XT,YT

```

NAVAL BIODYNAMICS LABORATORY SOFTWARE DOCUMENTATION

```

382      IF (NRED .EQ. 1) WRITE (10,2605) IDPT,X,Y,XT,YT
383 C
384 C Write Records for Triangulation Input to File: "img.dat"
385 C
386      WRITE (9,1610) IDPT,XT,YT,IFRAM(IANS)
387 390 CONTINUE
388 C
389 400 write (*,*) ' Re-do first fiducial'
390      READ (11) DATA
391      WRITE (*,*) CHAR(7)
392 C
393 C DECODE data from CHARACTER to INTEGER
394 C
395      if (ichar ( data(1:1) ) < 32) data(1:16) = data(2:17)
396      READ (DATA, 20) IBUTT,IX,IY
397      if(iabs(ix-isavex)+iabs(iy-isavey) .gt. 3*(rmsx+rmsy)/units)then
398          write (*,*) ' You blew it', ix, iy, ' vs.', isavex, isavey
399          WRITE (*,*) CHAR(7)
400          WRITE (*,*) CHAR(7)

```

F77L - Lahey FORTRAN 77, Version 5.01 20 Apr 93 14:51:12

Page 10

SUBROUTINE HEAD Compiling Options:

/NO/N2/N3/N7/NA/A1/NA2/NB/NC/C1/ND/NE/NF/H/I/NK/NL/P/NQ1/R/S/NT/NV/W/NX/NZ1

Source file Listing

```

401      go to 400
402      endif
403      PAUSE
404      WRITE (9,'(A8)') '*****'
405      GO TO 1
406 C*****
407 C
408 C Compute the Averaged Coordinates of the HRV head
409 C
410 500 DO 560 IRED=1,NRED
411      IHED=1
412 550 READ (11) DATA
413      WRITE (*,*) CHAR(7)
414 C
415 C DECODE data from CHARACTER to INTEGER
416 C
417      if (ichar ( data(1:1) ) < 32) data(1:16) = data(2:17)
418      READ (DATA, 20) IBUTT,IX,IY
419 C
420 C Interpret action to take based on which button was pressed:
421      IF (IBUTT .EQ. 3) THEN
422          XY(1,IHED,IRED)=IX*units
423          XY(2,IHED,IRED)=IY*units
424          WRITE (*,555)IHED(IHED),XY(1,IHED,IRED),XY(2,IHED,IRED)
425 555      FORMAT (A10,2X,F8.4,2X,F8.4)
426          IHED=IHED+1
427      ELSEIF (IBUTT .EQ. 2) THEN
428          IHED=IHED-1
429          WRITE (*,*) 'Backing up one to ',IHED(IHED)
430          WRITE (*,*) CHAR(7),CHAR(7)
431      ELSEIF (IBUTT .EQ. 1) THEN
432          XY(1,IHED,IRED)=-1.
433          XY(2,IHED,IRED)=-1.
434          WRITE (*,*) 'MISSING ', IHED(IHED)
435          IHED=IHED+1
436      ELSE
437          WRITE (*,*) 'Not an option. Redo'
438      ENDIF
439      IF (IHED .LE. NHED) GO TO 550

```

Anthropometry and Initial Conditions Photogrammetric Program

```

440 560 CONTINUE
441 C
442     DO 580 IHED=1,NHED
443         IF (XY(1,IHED,1).GT.0) WRITE (12,270) IDHED(IHED),
444             (XY(1,IHED,IRED),XY(2,IHED,IRED),IRED=1,NRED)
445 580 CONTINUE
446     WRITE (12,*)
447 C
448     IHED=0
449     DO 690 K=1,NHED

```

F77L - Lahey FORTRAN 77, Version 5.01 20 Apr 93 14:51:12

Page 11

SUBROUTINE HEAD Compiling Options:

/NO/N2/N3/N7/NA/A1/NA2/NB/NC/C1/ND/NE/NF/H/I/NK/NL/P/NQ1/R/S/NT/NV/W/NX/NZ1

Source file Listing

```

450 C
451 C Process measured head coordinates
452 C
453     IHED=IHED+1
454 590 IF (IHED.GT.NHED) GO TO 700
455     IF (XY(1,IHED,1).LE.0) then
456         IHED=IHED+1
457         GO TO 590
458     ENDIF
459     KK=IHED
460     XMAX=0.000
461     YMAX=0.000
462     XMIN=1000.000
463     YMIN=1000.000
464     SUMX=0.000
465     SUMY=0.000
466     DO 600 J=1,NRED
467         X=XY(1,IHED,J)
468         Y=XY(2,IHED,J)
469         IF (X.EQ.0.AND.Y.EQ.0) GO TO 610
470         SUMX=SUMX+X
471         SUMY=SUMY+Y
472         IF (NRED.EQ.1) GO TO 600
473         IF (XMAX.LT.X) XMAX=X
474         IF (XMIN.GT.X) XMIN=X
475         IF (YMAX.LT.Y) YMAX=Y
476         IF (YMIN.GT.Y) YMIN=Y
477 600 CONTINUE
478     IF (NRED.NE.1) GO TO 620
479 610 XMIN=0.000
480     YMIN=0.000
481 620 J=NRED
482     IF (J.EQ.0) J=1
483     X=SUMX/J
484     Y=SUMY/J
485     XM=XMAX-XMIN
486     YM=YMAX-YMIN
487     IDPT=IDHED(IHED)
488 C
489 C Correct Measured Coordinates for Film Shrinkage
490 C
491     XT=(X*DEL(1)+Y*DEL(2)+DEL(3))/(X*DEL(4)+Y*DEL(5)+1.0)
492     YT=(X*DEL(6)+Y*DEL(7)+DEL(8))/(X*DEL(4)+Y*DEL(5)+1.0)
493 C
494     IF (NRED .GT. 1) WRITE ( 8,1600) IDPT,X,Y,XT,YT,XM,YM
495     IF (NRED .GT. 1) WRITE (10,2600) IDPT,X,Y,XT,YT,XM,YM
496     IF (NRED .EQ. 1) WRITE ( 8,1605) IDPT,X,Y,XT,YT
497     IF (NRED .EQ. 1) WRITE (10,2605) IDPT,X,Y,XT,YT

```

NAVAL BIODYNAMICS LABORATORY SOFTWARE DOCUMENTATION

498 C
499 C Write Records for Triangulation Input to file: "img.dat"

F77L - Lahey FORTRAN 77, Version 5.01 20 Apr 93 14:51:12

Page 12

SUBROUTINE HEAD Compiling Options:

/N0/N2/N3/N7/NA/A1/NA2/NB/NC/C1/ND/NE/NF/H/I/NK/NL/P/NQ1/R/S/NT/NV/W/NX/NZ1

Source file Listing

```

500          WRITE ( 9,1610) IDPT,XT,YT,IFRAM(IANS)
501 690 CONTINUE
502 C
503 700 icount=0
504 710 write (*,*)' Re-do first fiducial'
505      READ (11) DATA
506      WRITE (*,*) CHAR(7)
507 C
508 C DECODE data from CHARACTER to INTEGER
509 C
510      if (ichar ( data(1:1) ) < 32) data(1:16) = data(2:17)
511      READ (DATA, 20) IBUTT,IX,IY
512      if(iabs(ix-isavex)+iabs(iy-isavey) .gt. 3*(rmsx+rmsy)/units)then
513          write (*,*)' You blew it', ix, iy, ' vs.', isavex, isavey
514          WRITE (*,*) CHAR(7)
515          WRITE (*,*) CHAR(7)
516          icount=icount+1
517          if(icount.le.4) go to 710
518          write(*, *)'No more tries...origin lost...going back to menu'
519          WRITE (9,'(A8)') '*****'
520          go to 1
521      endif
522      PAUSE
523      WRITE (9,'(A8)') '*****'
524      go to 1
525 C
526 999 CALL CLEAR
527      WRITE (12,'(A8)') '*****'
528      WRITE ( 8,*)CHAR(12)
529      WRITE (10,*)CHAR(12)
530 C FORMATTED OUTPUT FOR 132-COLUMN PAPER:
531 C
532 1370 FORMAT (2I1,8X,3F10.3)
533 1380 FORMAT (40X,'FIDUCIAL MEASUREMENTS OF FRAME ',A8// 36X,'ID',
534      . 12X,'AVERAGE',13X,'MAX SPREAD'/48X,'X',9X,'Y',11X,'X',9X,'Y')
535 1400 FORMAT (36X,'CALIBRATED FIDUCIAL COORDINATES OF FRAME ',A8//
536      . 46X, 'FID', 9X, 'X', 12X, 'Y' )
537 1410 FORMAT (2X,I4,4X,2F10.4)
538 1420 FORMAT (45X,I4,5X,F8.3,5X,F8.3)
539 1440 FORMAT (2D20.10)
540 1445 FORMAT (3D20.10)
541 1450 FORMAT (///42X,SP,'CALIBRATED FOCAL LENGTH = ',F9.3,' mm.')
542 1460 FORMAT (///51X,SP,'LENS DISTORTION'//51X,'RADIAL PARAMETERS'/31X
543      . 'K0='D15.8D2,' K1='D15.8D2,' K2='D15.8D2/51X'K3='D15.8D2
544      . '///45X,'LENS DECENTRATION PARAMETERS'/31X,'J1= 'D15.8D2,
545      . ' J2= 'D15.8D2,' PHI= 'D15.8D2/)
546 1470 FORMAT (12)
547 1480 FORMAT (2F10.3)
548 1485 FORMAT (8X,'Calibrated Focal Length (CFL) in millimeters = ')

```

Anthropometry and Initial Conditions Photogrammetric Program

F77L - Lahey FORTRAN 77, Version 5.01 20 Apr 93 14:51:12

Page 13

SUBROUTINE HEAD Compiling Options:

/NO/N2/N3/N7/NA/A1/NA2/NB/NC/C1/ND/NE/NF/H/I/NK/NL/P/NQ1/R/S/NT/NV/W/NX/NZ1

Source file Listing

```

549 1500 FORMAT (44X,2F13.3)
550 1510 FORMAT (6X,14,6F10.3)
551 1516 FORMAT (A8,2X,SP,F10.3,SS,2(F10.3),10X)
552 1540 FORMAT (36X,14,2X,2F10.3,2X,2F10.3)
553 1550 FORMAT (///138,'-PARAMETER RESIDUALS OF THE FIDUCIAL COORDINATES'//
554 . 43X, 'FID', 11X, 'X', 14X, 'Y' )
555 1560 FORMAT (42X,14,2F15.3)
556 1570 FORMAT (///42X,'PLATE COORDINATES FOR FRAME ',A8//22X,'ID',11X,
557 . 'MEASURED',13X,'ADJUSTED',13X,'MAX SPREAD',11X,'FRAME'/
558 . 34X,'X',9X,'Y',10X,'X',9X,'Y',10X,'X',9X,'Y')
559 1575 FORMAT (///42X,'PLATE COORDINATES FOR FRAME ',A8//38X,'ID',11X,
560 . 'MEASURED',13X,'ADJUSTED',50X,'X',9X,'Y',10X,'X',9X,'Y')
561 1580 FORMAT (2X,A8,6F10.3)
562 1600 FORMAT (18X,A8,2X,2F10.3,1X,2F10.3,1X,2F10.3)
563 1605 FORMAT (34X,A8,2X,2F10.3,1X,2F10.3)
564 1610 FORMAT (A8,2X,2F10.4,15X,'Photo ',A8)
565 C
566 C FORMATTED OUTPUT FOR 80-COLUMN PAPER:
567 C
568 2380 FORMAT (20X,'Fiducial Measurements of Frame ',A8// 16X,'ID',12X,
569 . 'Average',13X,'Max Spread',28X,'X',9X,'Y',11X,'X',9X,'Y')
570 2400 FORMAT (16X,'Calibrated Fiducial Coordinates of Frame ',A8//
571 . 26X, 'Fid', 9X, 'X', 12X, 'Y')
572 2420 FORMAT (25X,14,5X,F8.3,5X,F8.3)
573 2450 FORMAT (///25X,SP,'Calibrated Focal Length = ',F9.3,' mm.')
574 2460 FORMAT (////31X,SP,'Lens Distortion'//31X,'Radial Parameters'//11X
575 . 'K0='D15.8D2,' K1='D15.8D2,' K2='D15.8D2/31X'K3='D15.8D2
576 . ,//:25X,'Lens Decentration Parameters'//11X,'J1= 'D15.8D2,
577 . J2= 'D15.8D2,' PHI= 'D15.8D2/)
578 2500 FORMAT (24X,2F13.3)
579 2540 FORMAT (16X,14,2X,2F10.3,2X,2F10.3)
580 2550 FORMAT (///118,'-Parameter Residuals of the Fiducial Coordinates'//
581 . 23X, 'Fid', 11X, 'X', 14X, 'Y')
582 2560 FORMAT (22X,14,2F15.3)
583 2570 FORMAT (///22X,'Plate Coordinates for Frame ',A8// ID',11X,
584 . 'Measured',13X,'Adjusted',13X,'Max Spread',11X,'Frame'/
585 . 17X,'X',9X,'Y',10X,'X',9X,'Y',10X,'X',9X,'Y')
586 2575 FORMAT (///22X,'Plate Coordinates for Frame ',A8//18X,'ID',11X,
587 . 'Measured',13X,'Adjusted',30X,'X',9X,'Y',10X,'X',9X,'Y')
588 2600 FORMAT (X,A8,2X,2F10.3,1X,2F10.3,1X,2F10.3)
589 2605 FORMAT (14X,A8,2X,2F10.3,1X,2F10.3)
590 C
591 CALL BEEP
592 CLOSE (8)
593 CLOSE (9)
594 CLOSE (10)
595 END

```

F77L - Lahey FORTRAN 77, Version 5.01 20 Apr 93 14:51:12

Page 14

SUBROUTINE BODY Compiling Options:

/NO/N2/N3/N7/NA/A1/NA2/NB/NC/C1/ND/NE/NF/H/I/NK/NL/P/NQ1/R/S/NT/NV/W/NX/NZ1

Source file Listing

```

596
597 SUBROUTINE BODY
598 IMPLICIT DOUBLE PRECISION (A-H,O-Z)
599 CHARACTER DATA*17, fn1*12, fn2*12, fn3*12, fn4*12
600 CHARACTER*8 IFRAM(4),IDBOD(16), IDPT, DAY
601 CHARACTER JTITLE*42

```

NAVAL BIODYNAMICS LABORATORY SOFTWARE DOCUMENTATION

```

602      COMMON /TITLE/ JTITLE, I      Page
603      INTEGER      IDFD(10), IBUTT, IFID, IRED, IX, IY
604      REAL*8        XY(2,21,3), CALFID(2,10,2)
605      logical       iflag
606      EXTERNAL      SYSTEM
607      INTRINSIC      CHAR, DFLOAT, DSIN, DCOS, DSQRT
608      COMMON         CALCOR(2,50), OBSCOR(2,50), EQN(8,9), DEL(8), ICH3, NFID
609      DATA IFRAM /'LfEYlfSh', 'RtEYlfSh', 'LfEYrtSh', 'RtEYrtSh'/
610      DATA IDBOD /'Origin', 'Rib_Lf', 'Rib_Rt', 'SpineTop', 'SpineBot',
611      .             'spine_bb', 'sternum', 'lf_shold', 'rt_shold',
612      .             'ltp', 'rtp', 'ctp', 'lneckT', 'lneckB', 'rneckT', 'rneckB'/
613      DATA CALFID/ -190.190, -147.150, -77.030, -160.380, 77.220, -158.830,
614      .             192.510, -146.442, -190.060, 5.760, 191.570, 5.990,
615      .             -190.490, 157.980, -75.380, 146.070, 77.730, 147.920,
616      .             191.520, 158.540, -193.950, -148.160, -80.380, -162.380,
617      .             75.670, -164.310, 191.214, -148.961, -193.920, 5.010,
618      .             192.310, 4.800, -193.010, 159.210, -80.050, 147.600,
619      .             75.390, 144.880, 192.720, 158.520/
620  C .....
621  C      ALTEK DIGITIZER 4-BUTTON KEY CONTROL MEANINGS:
622  C      #2:RED=ERROR-BACKUP
623  C      #4:BLUE=??? #1:YELLOW=MISSING
624  C      #3:GREEN=FIDUCIAL or DATA POINT
625  C .....
626      NBOD=16
627      I      Page=0
628      WRITE (*,*) ' Enter COMM Port number: '
629      READ (*,*) Icomm
630      icmm=icmm+48
631      CALL SYSTEM ('MODE COM'//char(icmm)//':9600,0,7,2')
632      OPEN (11, FILE='COM'//char(icmm), ACCESS='TRANSPARENT')
633  C
634      WRITE (*,*) ' Enter HRV number: '
635      READ (*,*) IHRV
636      WRITE (*,*)
637      WRITE (FN1, '(14.4, ''BODY.OUT'')') IHRV
638      WRITE (FN2, '(14.4, ''body.132'')') IHRV
639      WRITE (FN3, '(14.4, ''bing.dat'')') IHRV
640      WRITE (FN4, '(14.4, ''body.in'')') IHRV
641      OPEN ( 8, FILE =FN2)
642      OPEN ( 9, FILE =FN3)
643      OPEN (10, FILE =FN1)
644      OPEN (12, FILE =FN4)

```

F77L - Lahey FORTRAN 77, Version 5.01 20 Apr 93 14:51:12

Page 15

SUBROUTINE BODY Compiling Options:

/NO/N2/N3/N7/NA/A1/NA2/NB/NC/C1/ND/NE/NF/H/I/NK/NL/P/NQ1/R/S/NT/NV/W/NX/NZ1

Source file Listing

```

645      CALL DATE (DAY)
646      WRITE (JTITLE,
647      .      '( '' HRV # '',15.5, '' Date: '',A8, '' BODY(T-1)'')') IHRV, DAY
648  C Read order of transformation
649      WRITE (*,*) ' Enter number of parameters for shrinkage fit: '
650      READ (*,*) IOPT1
651      WRITE (*,*)
652      units=25.4d-3
653      SDX = 1.0
654      SDY = 1.0
655      IF (IOPT1.GT.6) IOPT1=8
656      ICH3S=0
657      IF (IOPT1.LE.3) THEN
658          ICH3S=1
659          IOPT1=3

```

Anthropometry and Initial Conditions Photogrammetric Program

```

660      END IF
661 C      IOPT3=0
662 C      NRED indicates the number of replications of plate coordinates
663      NRED=1
664 C
665 1      WRITE (*,*) ' Enter 0 when finished'
666      WRITE (*,*) ' Enter 1 if: Left Eye View---Left Shoulder to Plate'
667      WRITE (*,*) ' Enter 2 if: Right Eye View---Left Shoulder to Plate'
668      WRITE (*,*) ' Enter 3 if: Left Eye View--Right Shoulder to Plate'
669      WRITE (*,*) ' Enter 4 if: Right Eye View--Right Shoulder to Plate'
670      WRITE (*,*)
671      READ (*,*) IANS
672      if(ians.eq.0) go to 999
673 C
674 C      Input data for the Preprocessing Program:
675 C      3, 4, 5, 6, 8 in col. 1 Three(etc)-parameter transformation
676 C
677 C      Calibrated Fiducial Coordinates in      FORMAT (2X,I4,4X,2F10.4)
678 C
679 C      Radial Lens Distortion Function:
680 C      Coefficients FK0, FK1      FORMAT (2D20.10)
681 C      Coefficients FK2, FK3      FORMAT (2D20.10)
682 C
683      CALL CLEAR
684 C
685      FOCAL= -889.0D0
686      CALL NEWPAG
687      WRITE (8,1400) IFRAM(IANS)
688      WRITE (10,2400)IFRAM(IANS)
689      write (12, '(i1, 9x, 3f10.3)')iopt1, focal, sdx, sdy
690 C
691 C      Write Calibrated Fiducial Coordinates
692 C
693      JFID=2

```

F77L - Lahey FORTRAN 77, Version 5.01 20 Apr 93 14:51:12

Page 16

SUBROUTINE BODY Compiling Options:

/NO/N2/N3/N7/NA/A1/NA2/NB/NC/C1/ND/NE/NF/H/I/NK/NL/P/NQ1/R/S/NT/NV/W/NX/NZ1

Source file Listing

```

694      do 8 ifid=1, 10
695      WRITE ( 8,1420) IFID,CALFID(1,IFID,JFID),CALFID(2,IFID,JFID)
696      WRITE (10,2420) IFID,CALFID(1,IFID,JFID),CALFID(2,IFID,JFID)
697 8      WRITE (12,1410) IFID,CALFID(1,IFID,JFID),CALFID(2,IFID,JFID)
698      write (12, '(/////)' )
699 C
700 C      Read & Write Frame ID
701 C
702      WRITE ( 9,1516) IFRAM(IANS), FOCAL, SDX, SDY
703      WRITE (12,'(A8)') IFRAM(IANS)
704      CALL NEWPAG
705      WRITE ( 8,1380) IFRAM(IANS)
706      WRITE (10,2380) IFRAM(IANS)
707      NRED=1
708 C*****
709 C      Start major loop for digitizing x-rays:
710      iflag=.true.
711      DO 40 IRED=1,NRED
712      IFID=1
713 10      READ (11) DATA
714      WRITE (*,*) CHAR(7)
715 C
716 C      DECODE data from CHARACTER to INTEGER
717 C

```

NAVAL BIODYNAMICS LABORATORY SOFTWARE DOCUMENTATION

```

718      if (ichar ( data(1:1) ) < 32) data(1:16) = data(2:17)
719      READ (DATA, 20) IBUTT,IX,IY
720 20    FORMAT (I1,1X,I6,1X,I6)
721  C
722  C Interpret action to take based on which button was pressed:
723      IF (IBUTT .EQ. 3) THEN
724          XY(1,IFID,IRED)=IX*units
725          XY(2,IFID,IRED)=IY*units
726          WRITE (*,30) 'FIDUCIAL',IFID,XY(1,IFID,IRED),XY(2,IFID,IRED)
727 30    FORMAT (' ',A,1X,I3,2X,F8.4,2X,F8.4)
728          if(iflag)then
729              isavex=ix
730              isavey=iy
731              iflag=.false.
732          endif
733          IFID=IFID+1
734      ELSEIF (IBUTT .EQ. 2) THEN
735          IFID=IFID-1
736          WRITE (*,*) 'Backing up one to FIDUCIAL # ',IFID
737          WRITE (*,*) CHAR(7),CHAR(7)
738      ELSEIF (IBUTT .EQ. 1) THEN
739          XY(1,IFID,IRED)=-1.
740          XY(2,IFID,IRED)=-1.
741          WRITE (*,*) 'MISSING ', IFID
742          IFID=IFID+1

```

F77L - Lahey FORTRAN 77, Version 5.01 20 Apr 93 14:51:12

Page 17

SUBROUTINE BODY Compiling Options:

/NO/N2/N3/N7/NA/A1/NA2/NB/NC/C1/ND/NE/NF/H/I/NK/NL/P/NQ1/R/S/NT/NV/W/NX/NZ1

Source file Listing

```

743      ELSE
744          WRITE (*,*) 'Not an option. Redo'
745      ENDIF
746      IF (IFID .LE. 10) GO TO 10
747 40    CONTINUE
748  C
749  C Write out the raw data to raw.dat
750      DO 60 IFID=1,10
751          IF (XY(1,IFID,1).GT.0) WRITE (12,50) IFID,( XY(1,IFID,IRED),
752              XY(2,IFID,IRED),IRED=1,NRED)
753 50    FORMAT (6X,I4,S,6F10.3)
754 60    CONTINUE
755          WRITE (12,*)
756  C
757          IFID=0
758          DO 200 K=1,10
759  C
760  C Read measured fiducial coordinates
761  C
762          IFID=IFID+1
763 80    IF (IFID.GT.10) GO TO 210
764          IF (XY(1,IFID,1).LE.0) then
765              IFID=IFID+1
766              GO TO 80
767          ENDIF
768          KK=IFID
769          XMAX=0.000
770          YMAX=0.000
771          XMIN=1000.000
772          YMIN=1000.000
773          SUMX=0.000
774          SUMY=0.000
775          DO 100 J=1,NRED

```


Anthropometry and Initial Conditions Photogrammetric Program

```

776          X=XY(1,IFID,J)
777          Y=XY(2,IFID,J)
778          IF (X.EQ.0.AND.Y.EQ.0) GO TO 110
779          SUMX=SUMX+X
780          SUMY=SUMY+Y
781          IF (NRED.EQ.1) GO TO 100
782          IF (XMAX.LT.X) XMAX=X
783          IF (XMIN.GT.X) XMIN=X
784          IF (YMAX.LT.Y) YMAX=Y
785          IF (YMIN.GT.Y) YMIN=Y
786 100      CONTINUE
787          IF (NRED.NE.1) GO TO 120
788 110      XMIN=0.0D0
789          YMIN=0.0D0
790 120      J=NRED
791          IF (J.EQ.0) J=1

```

F77L - Lahey FORTRAN 77, Version 5.01 20 Apr 93 14:51:12

Page 18

SUBROUTINE BODY Compiling Options:

/NO/N2/N3/N7/NA/A1/NA2/NB/NC/C1/ND/NE/NF/H/I/NK/NL/P/NQ1/R/S/NT/NV/W/NX/NZ1

Source file Listing

```

792          XT=SUMX/J
793          YT=SUMY/J
794  C      Store averaged digitized coordinates
795          OBSCOR(1,K)=XT
796          OBSCOR(2,K)=YT
797          CALCOR(1,K)=CALFID(1,KK,JFID)
798          CALCOR(2,K)=CALFID(2,KK,JFID)
799          IDFD(K)=KK
800          WRITE ( 8,1540) KK,XT,YT,XMAX-XMIN,YMAX-YMIN
801          WRITE (10,2540) KK,XT,YT,XMAX-XMIN,YMAX-YMIN
802 200      CONTINUE
803  C
804  C      Compute the 3-Parameter Check Transformation.
805  C
806 210      NFID=K-1
807          ICH3S=1
808          CALL FOURP
809          WRITE (*,*)' 3-Parameter Check Transformation'
810          rmsx=0.
811          rmsy=0.
812          DO 220 I=1,NFID
813              X=OBSCOR(1,I)
814              Y=OBSCOR(2,I)
815              XT=(X*DEL(1)+Y*DEL(2)+DEL(3))/(X*DEL(4)+Y*DEL(5)+1.0)-CALCOR(1,I)
816              YT=(X*DEL(6)+Y*DEL(7)+DEL(8))/(X*DEL(4)+Y*DEL(5)+1.0)-CALCOR(2,I)
817              KK=IDFD(I)
818              WRITE ( *,2560) KK,XT,YT
819              rmsx=rmsx+xt*xt
820              rmsy=rmsy+yt*yt
821 220      CONTINUE
822          rmsx3=dsqrt(rmsx/nfid)
823          rmsy3=dsqrt(rmsy/nfid)
824          write (*,230)rmsx, rmsy
825 230      format (' rms= ',2f7.3)
826          WRITE (*,*)
827          WRITE (*,*)iopt1,'-Parameter Transformation'
828          rmsx=0.
829          rmsy=0.
830  C
831  C      Compute the Multi-Parameter Transformation.
832          ICH3=ICH3S
833          IF (IOPT1.LE.5) CALL FOURP

```

NAVAL BIODYNAMICS LABORATORY SOFTWARE DOCUMENTATION

```

834      IF (IOPT1.EQ.5) CALL FIVEP
835      IF (IOPT1.EQ.6) CALL SIXP
836      IF (IOPT1.EQ.8) CALL EIGHTP
837      WRITE ( 8,1550) IOPT1
838      WRITE (10,2550) IOPT1
839  C
840  C  Compute Residuals For the Fiducial Coordinates
841  C

```

F77L - Lahey FORTRAN 77, Version 5.01 20 Apr 93 14:51:12

Page 19

SUBROUTINE BODY Compiling Options:

/NO/N2/N3/N7/NA/A1/NA2/NB/NC/C1/ND/NE/NF/H/I/NK/NL/P/NQ1/R/S/NT/NV/W/NX/NZ1

Source file Listing

```

842      DO 240 I=1,NFID
843          X=OBSCOR(1,I)
844          Y=OBSCOR(2,I)
845          XT=(X*DEL(1)+Y*DEL(2)+DEL(3))/(X*DEL(4)+Y*DEL(5)+1.0)-CALCOR(1,I)
846          YT=(X*DEL(6)+Y*DEL(7)+DEL(8))/(X*DEL(4)+Y*DEL(5)+1.0)-CALCOR(2,I)
847          KK=IDFD(I)
848          WRITE ( 8,1560) KK,XT,YT
849          WRITE (10,2560) KK,XT,YT
850          WRITE ( *,2560) KK,XT,YT
851          rmsx=rmsx+xt*xt
852          rmsy=rmsy+yt*yt
853      240 CONTINUE
854          rmsx=dsqrt(rmsx/nfid)
855          rmsy=dsqrt(rmsy/nfid)
856          write (*,230)rmsx, rmsy
857          write( 8, 1545)rmsx, rmsy, rmsx3, rmsy3, del
858          write(10, 2545)rmsx, rmsy, rmsx3, rmsy3, del
859      1545 FORMAT(/43X,'RMS',2F15.3/43X,'RMS(CHECK)',F8.3, F15.3/
860          .      /45X,'TRANSFORMATION PARAMETERS ARE: '/33X,2F11.6,F11.4,
861          .      2F11.6/33X,2F11.6,F11.4//)
862      2545 FORMAT(/23X,'Rms',2F15.3/23X,'Rms(check)',F8.3, F15.3/
863          .      /25X,'Transformation Parameters Are: '/13X,2F11.6,F11.4,
864          .      2F11.6/13X,2F11.6,F11.4)
865          CALL NEWPAG
866          IF (NRED .GT. 1) WRITE (8,1570) IFRAM(IANS)
867          IF (NRED .GT. 1) WRITE (10,2570)IFRAM(IANS)
868          IF (NRED .EQ. 1) WRITE (8,1575) IFRAM(IANS)
869          IF (NRED .EQ. 1) WRITE (10,2575)IFRAM(IANS)
870          PAUSE
871  C*****
872  C
873  C  Compute the Averaged Coordinates of the HRV body
874  C
875      500 DO 560 IRED=1,NRED
876          IBOD=1
877      550 READ (11) DATA
878          WRITE (*,*) CHAR(7)
879  C
880  C  DECODE data from CHARACTER to INTEGER
881  C
882          if (ichar ( data(1:1) ) < 32) data(1:16) = data(2:17)
883          READ (DATA, 20) IBUTT,IX,IY
884  C
885  C  Interpret action to take based on which button was pressed:
886          IF (IBUTT .EQ. 3) THEN
887              XY(1,IBOD,IRED)=IX*units
888              XY(2,IBOD,IRED)=IY*units
889              WRITE (*,555)IBOD(IBOD),XY(1,IBOD,IRED),XY(2,IBOD,IRED)
890      555      FORMAT (A10,2X,F8.4,2X,F8.4)

```

Anthropometry and Initial Conditions Photogrammetric Program

F77L - Lahey FORTRAN 77, Version 5.01 20 Apr 93 14:51:12
SUBROUTINE BODY Compiling Options:
/NO/N2/N3/N7/NA/A1/NA2/NB/NC/C1/ND/NE/NF/H/I/NK/NL/P/NQ1/R/S/NT/NV/W/NX/NZ1
Source file Listing

Page 20

```
891      IBOD=IBOD+1
892      ELSEIF (IBUTT .EQ. 2) THEN
893      IBOD=IBOD-1
894      WRITE (*,*) 'Backing up one to ', IDBOD(IBOD)
895      WRITE (*,*) CHAR(7),CHAR(7)
896      ELSEIF (IBUTT .EQ. 1) THEN
897      XY(1,IBOD,IREO)=-1.
898      XY(2,IBOD,IREO)=-1.
899      WRITE (*,*) 'MISSING ', IDBOD(IBOD)
900      IBOD=IBOD+1
901      ELSE
902      WRITE (*,*) 'Not an option. Redo'
903      ENDIF
904      IF (IBOD .LE. NBOD) GO TO 550
905 560 CONTINUE
906 C
907      DO 580 IBOD=1,NBOD
908      IF (XY(1,IBOD,1).GT.0) WRITE (12,270) IDBOD(IBOD),
909      .      (XY(1,IBOD,IREO),XY(2,IBOD,IREO),IREO=1,NREO)
910 270      FORMAT (2X,A8,1X,S,6(F9.4,1X))
911 580 CONTINUE
912      WRITE (12,*)
913 C
914      IBOD=0
915      DO 690 K=1,NBOD
916 C
917 C Process measured body coordinates
918 C
919      IBOD=IBOD+1
920 590      IF (IBOD.GT.NBOD) GO TO 700
921      IF (XY(1,IBOD,1).LE.0) then
922      IBOD=IBOD+1
923      GO TO 590
924      ENDIF
925      KK=IBOD
926      XMAX=0.000
927      YMAX=0.000
928      XMIN=1000.000
929      YMIN=1000.000
930      SUMX=0.000
931      SUMY=0.000
932      DO 600 J=1,NREO
933      X=XY(1,IBOD,J)
934      Y=XY(2,IBOD,J)
935      IF (X.EQ.0.AND.Y.EQ.0) GO TO 610
936      SUMX=SUMX+X
937      SUMY=SUMY+Y
938      IF (NREO.EQ.1) GO TO 600
939      IF (XMAX.LT.X) XMAX=X
```

F77L - Lahey FORTRAN 77, Version 5.01 20 Apr 93 14:51:12
SUBROUTINE BODY Compiling Options:
/NO/N2/N3/N7/NA/A1/NA2/NB/NC/C1/ND/NE/NF/H/I/NK/NL/P/NQ1/R/S/NT/NV/W/NX/NZ1
Source file Listing

Page 21

```
940      IF (XMIN.GT.X) XMIN=X
941      IF (YMAX.LT.Y) YMAX=Y
942      IF (YMIN.GT.Y) YMIN=Y
```

NAVAL BIODYNAMICS LABORATORY SOFTWARE DOCUMENTATION

```

943 600      CONTINUE
944          IF (NRED.NE.1) GO TO 620
945 610      XMIN=0.0D0
946          YMIN=0.0D0
947 620      J=NRED
948          IF (J.EQ.0) J=1
949          X=SUMX/J
950          Y=SUMY/J
951          XM=XMAX-XMIN
952          YM=YMAX-YMIN
953          IDPT=IDBOD(IBOD)
954 C
955 C   Correct Measured Coordinates for Film Shrinkage
956 C
957          XT=(X*DEL(1)+Y*DEL(2)+DEL(3))/(X*DEL(4)+Y*DEL(5)+1.0)
958          YT=(X*DEL(6)+Y*DEL(7)+DEL(8))/(X*DEL(4)+Y*DEL(5)+1.0)
959 C
960          IF (NRED .GT. 1) WRITE ( 8,1600) IDPT,X,Y,XT,YT,XM,YM
961          IF (NRED .GT. 1) WRITE (10,2600) IDPT,X,Y,XT,YT,XM,YM
962          IF (NRED .EQ. 1) WRITE ( 8,1605) IDPT,X,Y,XT,YT
963          IF (NRED .EQ. 1) WRITE (10,2605) IDPT,X,Y,XT,YT
964 C
965 C   Write Records for Triangulation Input to file: "img.dat"
966          WRITE ( 9,1610) IDPT,XT,YT,IFRAM(IANS)
967 690      CONTINUE
968 C
969 700      icount=0
970 710      write (*,*) ' Re-do first fiducial'
971          READ (11) DATA
972          WRITE (*,*) CHAR(7)
973 C
974 C   DECODE data from CHARACTER to INTEGER
975 C
976          if (ichar ( data(1:1) ) < 32) data(1:16) = data(2:17)
977          READ (DATA, 20) IBUTT,IX,IY
978          if(iabs(ix-isavex)+iabs(iy-isavey) .gt. 3*(rmsx+rmsy)/units)then
979              write (*,*) ' You blew it', ix, iy, ' vs.', isavex, isavey
980              WRITE (*,*) CHAR(7)
981              WRITE (*,*) CHAR(7)
982              icount=icount+1
983              if(icount.le.4) go to 710
984              write(*, *)'No more tries...origin lost...going back to menu'
985              WRITE (9,'(A8)') '*****'
986              go to 1
987          endif
988          PAUSE

```

F77L - Lahey FORTRAN 77, Version 5.01 20 Apr 93 14:51:12

Page 22

SUBROUTINE BODY Compiling Options:

/N0/N2/N3/N7/NA/A1/NA2/NB/NC/C1/ND/NE/NF/H/I/NK/NL/P/NQ1/R/S/NT/NV/W/NX/NZ1

Source file Listing

```

989      WRITE (9,'(A8)') '*****'
990      go to 1
991 C
992 999      CALL CLEAR
993          WRITE (12,'(A8)') '*****'
994          WRITE ( 8,*)CHAR(12)
995          WRITE (10,*)CHAR(12)
996 C   FORMATTED OUTPUT FOR 132-COLUMN PAPER:
997 C
998 1370      FORMAT (2I1,8X,3F10.3)
999 1380      FORMAT (40X,'FIDUCIAL MEASUREMENTS OF FRAME ',A8// 36X,'ID',
1000          . 12X,'AVERAGE',13X,'MAX SPREAD'/48X,'X',9X,'Y',11X,'X',9X,'Y')

```

Anthropometry and Initial Conditions Photogrammetric Program

```

1001 1400 FORMAT (36X,'CALIBRATED FIDUCIAL COORDINATES OF FRAME ',A8//
1002 . 46X, 'FID', 9X, 'X', 12X, 'Y' )
1003 1410 FORMAT (2X,I4,4X,2F10.4)
1004 1420 FORMAT (45X,I4,5X,F8.3,5X,F8.3)
1005 1440 FORMAT (2D20.10)
1006 1445 FORMAT (3D20.10)
1007 1450 FORMAT (///42X,SP,'CALIBRATED FOCAL LENGTH = ',F9.3,' mm.')
```

```

1008 1460 FORMAT (////51X,SP,'LENS DISTORTION'//51X,'RADIAL PARAMETERS'/31X
1009 . 'K0='D15.8D2,' K1='D15.8D2,' K2='D15.8D2/51X'K3='D15.8D2
1010 . ,//:45X,'LENS DECENTRATION PARAMETERS'/31X,'J1= 'D15.8D2,
1011 . ' J2= 'D15.8D2,' PHI= 'D15.8D2/)
1012 1470 FORMAT (12)
1013 1480 FORMAT (2F10.3)
1014 1485 FORMAT (8X,'Calibrated Focal Length (CFL) in millimeters = ')
1015 1500 FORMAT (44X,2F13.3)
1016 1510 FORMAT (6X,I4,6F10.3)
1017 1516 FORMAT (A8,2X,SP,F10.3:,SS,2(F10.3),10X)
1018 1540 FORMAT (36X,I4,2X,2F10.3,2X,2F10.3)
1019 1550 FORMAT (///138,'-PARAMETER RESIDUALS OF THE FIDUCIAL COORDINATES'//
1020 . 43X, 'FID', 11X, 'X', 14X, 'Y' )
1021 1560 FORMAT (42X,I4,2F15.3)
1022 1570 FORMAT (///42X,'PLATE COORDINATES FOR FRAME ',A8//22X,'ID',11X,
1023 . 'MEASURED',13X,'ADJUSTED',13X,'MAX SPREAD',11X,'FRAME'/
1024 . 34X,'X',9X,'Y',10X,'X',9X,'Y',10X,'X',9X,'Y')
1025 1575 FORMAT (///42X,'PLATE COORDINATES FOR FRAME ',A8//38X,'ID',11X,
1026 . 'MEASURED',13X,'ADJUSTED',50X,'X',9X,'Y',10X,'X',9X,'Y')
1027 1580 FORMAT (2X,A8,6F10.3)
1028 1600 FORMAT (18X,A8,2X,2F10.3,1X,2F10.3,1X,2F10.3)
1029 1605 FORMAT (34X,A8,2X,2F10.3,1X,2F10.3)
1030 1610 FORMAT (A8,2X,2F10.4,15X,'Photo ',A8)
1031 C
1032 C FORMATTED OUTPUT FOR 80-COLUMN PAPER:
1033 C
1034 2380 FORMAT (20X,'Fiducial Measurements of Frame ',A8// 16X,'ID',12X,
1035 . 'Average',13X,'Max Spread'/28X,'X',9X,'Y',11X,'X',9X,'Y')
1036 2400 FORMAT (16X,'Calibrated Fiducial Coordinates of Frame ',A8//
1037 . 26X, 'Fid', 9X, 'X', 12X, 'Y')
```

F77L - Lahey FORTRAN 77, Version 5.01 20 Apr 93 14:51:12
 SUBROUTINE BODY Compiling Options:
 /NO/N2/N3/N7/NA/A1/NA2/NB/NC/C1/ND/NE/NF/H/I/NK/NL/P/NQ1/R/S/NT/NV/W/NX/NZ1
 Source file Listing

Page 23

```

1038 2420 FORMAT (25X,I4,5X,F8.3,5X,F8.3)
1039 2450 FORMAT (///25X,SP,'Calibrated Focal Length = ',F9.3,' mm.')
```

```

1040 2460 FORMAT (////31X,SP,'Lens Distortion'//31X,'Radial Parameters'/11X
1041 . 'K0='D15.8D2,' K1='D15.8D2,' K2='D15.8D2/31X'K3='D15.8D2
1042 . ,//:25X,'Lens Decentration Parameters'/11X,'J1= 'D15.8D2,
1043 . ' J2= 'D15.8D2,' PHI= 'D15.8D2/)
1044 2500 FORMAT (24X,2F13.3)
1045 2540 FORMAT (16X,I4,2X,2F10.3,2X,2F10.3)
1046 2550 FORMAT (///118,'-Parameter Residuals of the Fiducial Coordinates'//
1047 . 23X, 'Fid', 11X, 'X', 14X, 'Y')
1048 2560 FORMAT (22X,I4,2F15.3)
1049 2570 FORMAT (///22X,'Plate Coordinates for Frame ',A8// ID',11X,
1050 . 'Measured',13X,'Adjusted',13X,'Max Spread',11X,'Frame'/
1051 . 17X,'X',9X,'Y',10X,'X',9X,'Y',10X,'X',9X,'Y')
1052 2575 FORMAT (///22X,'Plate Coordinates for Frame ',A8//18X,'ID',11X,
1053 . 'Measured',13X,'Adjusted',30X,'X',9X,'Y',10X,'X',9X,'Y')
1054 2600 FORMAT (X,A8,2X,2F10.3,1X,2F10.3,1X,2F10.3)
1055 2605 FORMAT (14X,A8,2X,2F10.3,1X,2F10.3)
1056 C
1057 CALL BEEP
1058 CLOSE (8)
```

NAVAL BIODYNAMICS LABORATORY SOFTWARE DOCUMENTATION

```
1059      CLOSE (9)
1060      CLOSE (10)
1061      END
```

F77L - Lahey FORTRAN 77, Version 5.01 20 Apr 93 14:51:12

Page 24

SUBROUTINE FOURP Compiling Options:
/NO/N2/N3/N7/NA/A1/NA2/NB/NC/C1/ND/NE/NF/H/I/NK/NL/P/NQ1/R/S/NT/NV/W/NX/NZ1
Source file Listing

```
1062
1063      SUBROUTINE FOURP
1064      C
1065      C Calculate the 3 or 4 Parameter Transformation Between an Exact Set
1066      C of Data and a Corresponding Set of Measured Data.
1067      C
1068      IMPLICIT DOUBLE PRECISION (A-H,O-Z)
1069      INTRINSIC DSQRT
1070      DIMENSION AM(2,4), CM(2)
1071      COMMON CALCOR(2,50),OBSCOR(2,50),EQN(8,9),DEL(8),ICH3, NFID
1072      C
1073      DO 1010 I=1,4
1074          DO 1010 J=1,5
1075              EQN(I,J)=0.0D0
1076      1010 CONTINUE
1077      AM(1,3)=1.0D0
1078      AM(1,4)=0.0D0
1079      AM(2,3)=0.0D0
1080      AM(2,4)=1.0D0
1081      DO 1030 I=1,NFID
1082          AM(1,1)=OBSCOR(1,I)
1083          AM(1,2)=OBSCOR(2,I)
1084          AM(2,1)=AM(1,2)
1085          AM(2,2)=-AM(1,1)
1086          CM(1)=CALCOR(1,I)
1087          CM(2)=CALCOR(2,I)
1088          DO 1020 J=1,4
1089              DO 1020 K=1,2
1090                  EQN(J,5)=EQN(J,5)+AM(K,J)*CM(K)
1091              DO 1020 L=1,4
1092                  EQN(J,L)=EQN(J,L)+AM(K,J)*AM(K,L)
1093      1020 CONTINUE
1094      1030 CONTINUE
1095      CALL LINSOL(4)
1096      IF (ICH3.EQ.0) GO TO 1060
1097      C
1098      C If ICH3<>0 Transform the 4-param to a 3-param
1099      C
1100      SCALE=EQN(1,5)**2+EQN(2,5)**2
1101      SCALE=DSQRT(SCALE)
1102      EQN(1,5)=EQN(1,5)/SCALE
1103      EQN(2,5)=EQN(2,5)/SCALE
1104      SUM1=0.0D0
1105      SUM2=0.0D0
1106      DO 1050 I=1,NFID
1107          X=OBSCOR(1,I)
1108          Y=OBSCOR(2,I)
1109          SUM1=SUM1+CALCOR(1,I)-EQN(1,5)*X-EQN(2,5)*Y
1110          SUM2=SUM2+CALCOR(2,I)+EQN(2,5)*X-EQN(1,5)*Y
```

Anthropometry and Initial Conditions Photogrammetric Program

F77L - Lahey FORTRAN 77, Version 5.01 20 Apr 93 14:51:12

Page 25

SUBROUTINE FOURP Compiling Options:
/NO/N2/N3/N7/NA/A1/NA2/NB/NC/C1/ND/NE/NF/H/I/NK/NL/P/NQ1/R/S/NT/NV/W/NX/NZ1
Source file Listing

```
1111 1050 CONTINUE
1112      EQN(3,5)=SUM1/NFID
1113      EQN(4,5)=SUM2/NFID
1114 C
1115 C Form transformation parameters vector
1116 C
1117 1060 DEL(1)=EQN(1,5)
1118      DEL(2)=EQN(2,5)
1119      DEL(3)=EQN(3,5)
1120      DEL(4)=0.000
1121      DEL(5)=0.000
1122      DEL(6)=-DEL(2)
1123      DEL(7)=DEL(1)
1124      DEL(8)=EQN(4,5)
1125      END
```

F77L - Lahey FORTRAN 77, Version 5.01 20 Apr 93 14:51:12

Page 26

SUBROUTINE FIVEP Compiling Options:
/NO/N2/N3/N7/NA/A1/NA2/NB/NC/C1/ND/NE/NF/H/I/NK/NL/P/NQ1/R/S/NT/NV/W/NX/NZ1
Source file Listing

```
1126
1127      SUBROUTINE FIVEP
1128 C
1129 C Calculate the FIVE Parameter Transformation Between an Exact Set
1130 C of Data and a Corresponding Set of Measured Data.
1131 C
1132      IMPLICIT DOUBLE PRECISION (A-H,O-Z)
1133      INTRINSIC DSIN, DCOS, DABS
1134      DIMENSION B(2,5),C(2),CV(5),PAR(5)
1135      COMMON CALCOR(2,50),OBSCOR(2,50),EQN(8,9),DEL(8),ICH3, NFID
1136 C
1137      PAR(1)=DSQRT(DEL(1)**2+DEL(2)**2)
1138      PAR(2)=PAR(1)
1139      PAR(3)=DATAN2(DEL(2),DEL(1))
1140      PAR(4)=DEL(3)
1141      PAR(5)=DEL(8)
1142      B(1,2)=0.000
1143      B(1,5)=0.000
1144      B(2,1)=0.000
1145      B(2,4)=0.000
1146      DO 30 I=1,10
1147      DO 2 I=1, 5
1148          CV(I)=0.000
1149      DO 2 J=1, 5
1150 2      EQN(I, J)=0.000
1151      DO 10 I=1,NFID
1152          B(1,4)=PAR(1)
1153          B(2,5)=PAR(2)
1154          SINT=DSIN(PAR(3))
1155          COST=DCOS(PAR(3))
1156          X=OBSCOR(1,I)
1157          Y=OBSCOR(2,I)
1158          C1=-X*SINT+Y*COST
1159          C2= X*COST+Y*SINT
1160          B(1,1)=C2*PAR(1)
1161          B(1,3)=C1*PAR(1)**2
1162          B(2,2)=C1*PAR(2)
1163          B(2,3)=-C2*PAR(2)**2
```

NAVAL BIODYNAMICS LABORATORY SOFTWARE DOCUMENTATION

```

1164      C(1)=PAR(1)*(CALCOR(1,I)-PAR(1)*C2-PAR(4))
1165      C(2)=PAR(2)*(CALCOR(2,I)-PAR(2)*C1-PAR(5))
1166      DO 10 J=1,5
1167      DO 10 K=1,2
1168          CV(J)=CV(J)+B(K,J)*C(K)
1169      DO 10 L=1,5
1170          EQN(J,L)=EQN(J,L)+B(K,J)*B(K,L)
1171 10      CONTINUE
1172 C
1173 C      Solve normal equations
1174 C
1175      CALL LINSOL(5)

```

F77L - Lahey FORTRAN 77, Version 5.01 20 Apr 93 14:51:12

Page 27

SUBROUTINE FIVEP Compiling Options:
 /NO/N2/N3/N7/NA/A1/NA2/NB/NC/C1/ND/NE/NF/H/I/NK/NL/P/NQ1/R/S/NT/NV/W/NX/NZ1
 Source file Listing

```

1176      DO 15 J=1, 5
1177 15      PAR(J)=PAR(J)+EQN(J, 6)
1178 C
1179 C      Test for convergence
1180 C
1181      DO 20 J=1, 5
1182          C1=DABS(EQN(J, 6))
1183          EPSLN=1.0D-6
1184          IF(J.GT.3)EPSLN=1.0D-4
1185          IF(C1.GT.EPSLN)GO TO 30
1186 20      CONTINUE
1187          GO TO 40
1188 30      CONTINUE
1189          CALL CLEAR
1190          CALL BEEP
1191          WRITE(*,*)' Error in FIVEP'
1192          STOP
1193 C
1194 C      Form transformation parameters vector
1195 C
1196 40      SINT=DSIN(PAR(3))
1197          COST=DCOS(PAR(3))
1198          DEL(1)=PAR(1)*COST
1199          DEL(2)=PAR(1)*SINT
1200          DEL(3)=PAR(4)
1201          DEL(4)=0.0D0
1202          DEL(5)=0.0D0
1203          DEL(6)=-PAR(2)*SINT
1204          DEL(7)=PAR(2)*COST
1205          DEL(8)=PAR(5)
1206          END

```

F77L - Lahey FORTRAN 77, Version 5.01 20 Apr 93 14:51:12

Page 28

SUBROUTINE SIXP Compiling Options:
 /NO/N2/N3/N7/NA/A1/NA2/NB/NC/C1/ND/NE/NF/H/I/NK/NL/P/NQ1/R/S/NT/NV/W/NX/NZ1
 Source file Listing

```

1207
1208      SUBROUTINE SIXP
1209 C
1210 C      Calculate the SIX Parameter Transformation Between an Exact Set
1211 C      of Data and a Corresponding Set of Measured Data.
1212 C
1213      IMPLICIT DOUBLE PRECISION (A-H,O-Z)

```


Anthropometry and Initial Conditions Photogrammetric Program

```

1214      DIMENSION ANS(2,3), CCC(3,3), DDD(3,2), RRR(2,2), ERR(2)
1215      COMMON      CALCOR(2,50),OBSCOR(2,50),EQN(8,9),DEL(8),ICH3, NFID
1216      C
1217      C Zero Normal Equation Area.
1218      C
1219          DO 1010 I=1,2
1220              DO 1010 J=1,3
1221                  CCC(I,J)=0.000
1222                  DDD(J,I)=0.000
1223      1010 CONTINUE
1224      C
1225      C Compute Normal Equations
1226      C
1227          DO 1020 I=1,NFID
1228              DO 1020 J=1,2
1229                  CCC(J,3)=CCC(J,3)+CALCOR(J,I)
1230                  DDD(3,J)=DDD(3,J)+OBSCOR(J,I)
1231              DO 1020 K=1,2
1232                  CCC(J,K)=CCC(J,K)+CALCOR(J,I)*CALCOR(K,I)
1233                  DDD(J,K)=DDD(J,K)+CALCOR(J,I)*OBSCOR(K,I)
1234      1020 CONTINUE
1235          CCC(3,1)=CCC(1,3)
1236          CCC(3,2)=CCC(2,3)
1237          CCC(3,3)=NFID
1238      C
1239      C Compute Inverse of Normal Matrix.
1240      C
1241          IGGY=3
1242          CALL INVERT (CCC,IGGY,DET)
1243      C
1244      C Compute the Transformation Parameters
1245      C
1246          DO 1030 I=1,2
1247              DO 1030 J=1,3
1248                  ANS(I,J)=0.000
1249              DO 1030 K=1,3
1250                  ANS(I,J)=ANS(I,J)+CCC(J,K)*DDD(K,I)
1251      C
1252      C Calculate the Transformation from Measured Data to Exact Data.
1253      C
1254          DO 1040 I=1,2
1255              DO 1040 J=1,2

```

F77L - Lahey FORTRAN 77, Version 5.01 20 Apr 93 14:51:12

Page 29

SUBROUTINE SIXP Compiling Options:

/NO/N2/N3/N7/NA/A1/NA2/NB/NC/C1/ND/NE/NF/H/I/NK/NL/P/NQ1/R/S/NT/NV/W/NX/NZ1

Source file Listing

```

1256      1040      RRR(I,J)=ANS(I,J)
1257          IGGY=2
1258          CALL INVERT (RRR,IGGY,DET)
1259          DO 1050 I=1,2
1260              DO 1050 J=1,2
1261                  ANS(I,J)=RRR(I,J)
1262          DO 1060 I=1,2
1263      1060      ERR(I)=-ANS(1,1)*ANS(1,3)-ANS(1,2)*ANS(2,3)
1264          DO 1070 I=1,2
1265      1070      ANS(I,3)=ERR(I)
1266      C
1267      C Form transformation parameters vector
1268      C
1269          DEL(1)=ANS(1,1)
1270          DEL(2)=ANS(1,2)
1271          DEL(3)=ANS(1,3)

```

NAVAL BIODYNAMICS LABORATORY SOFTWARE DOCUMENTATION

```

1272      DEL(4)=0.0D0
1273      DEL(5)=0.0D0
1274      DEL(6)=ANS(2,1)
1275      DEL(7)=ANS(2,2)
1276      DEL(8)=ANS(2,3)
1277      END

```

F77L - Lahey FORTRAN 77, Version 5.01 20 Apr 93 14:51:12

Page 30

SUBROUTINE EIGHTP Compiling Options:

/NO/N2/N3/N7/NA/A1/NA2/NB/NC/C1/ND/NE/NF/H/I/NK/NL/P/NQ1/R/S/NT/NV/W/NX/NZ1

Source file Listing

```

1278
1279      SUBROUTINE EIGHTP
1280  C
1281  C Calculate the EIGHT Parameter Transformation Between an Exact Set
1282  C of Data and a Corresponding Set of Measured Data.
1283  C
1284      IMPLICIT DOUBLE PRECISION (A-H,O-Z)
1285      INTRINSIC DABS
1286      COMMON CALCOR(2,50),OBSCOR(2,50),EQN(8,9),DEL(8),ICH3, NFID
1287      real*8      tem(8)
1288  C
1289  C Zero the matrix of linear equations EQN
1290  C
1291      DO 1 I=1,8
1292          del(i)=0.0d0
1293          DO 1 J=1,9
1294      1      EQN(I,J)=0.0D0
1295  C
1296  C Compute approximate values for the transformation parameters
1297  C
1298      DO 10 I=1,NFID
1299      10  CALL ACCAPR (CALCOR(1,I),CALCOR(2,I),OBSCOR(1,I),OBSCOR(2,I))
1300      N=8
1301      call invert(eqn, n, d)
1302      do 15 i=1, 8
1303      do 15 j=1, 8
1304      15  del(i)=del(i)+eqn(i, j)*eqn(j, 9)
1305  C
1306  C Compute the transformation parameters by least squares
1307  C
1308      DO 50 M=1,5
1309  C
1310  C Zero the normal equations
1311  C
1312      DO 18 I=1,8
1313          tem(i)=0.0d0
1314          DO 18 J=1,9
1315      18  EQN(I,J)=0.0D0
1316  C
1317  C Form the normal equations
1318  C
1319      DO 20 I=1,NFID
1320      20  CALL ACCNEQ (CALCOR(1,I),CALCOR(2,I),OBSCOR(1,I),OBSCOR(2,I))
1321  C
1322  C Solve the normal equations
1323  C
1324      call invert(eqn, n, d)
1325      do 25 i=1, 8
1326      do 25 j=1, 8

```

Anthropometry and Initial Conditions Photogrammetric Program

F77L - Lahey FORTRAN 77, Version 5.01 20 Apr 93 14:51:12

Page 31

SUBROUTINE EIGHTP Compiling Options:

/NO/N2/N3/N7/NA/A1/NA2/NB/NC/C1/ND/NE/NF/H/I/NK/NL/P/NQ1/R/S/NT/NV/W/NX/NZ1

Source file Listing

```
1327 25      tem(i)=tem(i)+eqn(i, j)*eqn(j, 9)
1328 C
1329 C Correct the approximate values of the transformation parameters
1330 C
1331      do 30 i=1, 8
1332 30      del(i)=del(i)+tem(i)
1333 C
1334 C Test the solution for convergence
1335 C
1336      DO 40 I=1,8
1337          D=DABS(DEL(I))/(DEL(I)-tem(I))-1.0)
1338          IF (D.GT..001D0) GO TO 50
1339 40      CONTINUE
1340      RETURN
1341 50      CONTINUE
1342      END
```

F77L - Lahey FORTRAN 77, Version 5.01 20 Apr 93 14:51:12

Page 32

SUBROUTINE LINSOL Compiling Options:

/NO/N2/N3/N7/NA/A1/NA2/NB/NC/C1/ND/NE/NF/H/I/NK/NL/P/NQ1/R/S/NT/NV/W/NX/NZ1

Source file Listing

```
1343
1344      SUBROUTINE LINSOL(NPAR)
1345 C
1346 C Solution of (NPAR) linear equations in (NPAR) unknowns.
1347 C
1348      IMPLICIT DOUBLE PRECISION (A-H,O-Z)
1349      COMMON CALCOR(2,50),OBSCOR(2,50),EQN(8,9),DEL(8),ICH3, NFID
1350 C
1351      DO 1040 K=1,NPAR
1352          M=NPAR+1
1353          DO 1010 J=K,NPAR+1
1354              EQN(K,M)=EQN(K,M)/EQN(K,K)
1355 1010      M=M-1
1356          DO 1030 I=1,NPAR
1357              IF (I.EQ.K) GO TO 1030
1358              M=NPAR+1
1359              DO 1020 L=K,NPAR+1
1360                  EQN(I,M)=EQN(I,M)-EQN(I,K)*EQN(K,M)
1361 1020      M=M-1
1362 1030      CONTINUE
1363 1040 CONTINUE
1364 C
1365      END
```

F77L - Lahey FORTRAN 77, Version 5.01 20 Apr 93 14:51:12

Page 33

SUBROUTINE ACCAPR Compiling Options:

/NO/N2/N3/N7/NA/A1/NA2/NB/NC/C1/ND/NE/NF/H/I/NK/NL/P/NQ1/R/S/NT/NV/W/NX/NZ1

Source file Listing

```
1366
1367      SUBROUTINE ACCAPR (XG,YG,XP,YP)
1368 C
1369 C Evaluate the contribution of one point to the 8 by 9 matrix of
1370 C normal equations for computation of approximate values of the
1371 C eight-parameter film shrinkage transformation.
```

NAVAL BIODYNAMICS LABORATORY SOFTWARE DOCUMENTATION

```

1372 C
1373 C      XG: Calibrated X Fiducial coordinate
1374 C      YG: Calibrated Y Fiducial coordinate
1375 C      XP: Observed X Fiducial coordinate
1376 C      YP: Observed Y Fiducial coordinate
1377 C      EQN: 8 X 8 Coefficient matrix of the Normal Equation
1378 C           with the vector of constants in column 9.
1379 C
1380      IMPLICIT DOUBLE PRECISION (A-H,O-Z)
1381      DIMENSION AM(2,8), BM(2)
1382      COMMON      CALCOR(2,50),OBSCOR(2,50),EQN(8,9),DEL(8),ICH3, NFID
1383 C
1384      AM(1,1)=XP
1385      AM(1,2)=YP
1386      AM(1,3)=1.0D0
1387      AM(1,4)=-XG*XP
1388      AM(1,5)=-XG*YP
1389      AM(1,6)=0.0D0
1390      AM(1,7)=0.0D0
1391      AM(1,8)=0.0D0
1392      AM(2,1)=0.0D0
1393      AM(2,2)=0.0D0
1394      AM(2,3)=0.0D0
1395      AM(2,4)=-XP*YG
1396      AM(2,5)=-YP*YG
1397      AM(2,6)=XP
1398      AM(2,7)=YP
1399      AM(2,8)=1.0D0
1400      BM(1)=XG
1401      BM(2)=YG
1402      DO 1010 I=1,8
1403          DO 1010 J=1,8
1404              DO 1010 K=1,2
1405                  1010      EQN(I,J)=EQN(I,J)+AM(K,I)*AM(K,J)
1406              DO 1020 I=1,8
1407                  DO 1020 J=1,2
1408                      1020      EQN(I,9)=EQN(I,9)+AM(J,I)*BM(J)
1409 C
1410      END

```

F77L - Lahey FORTRAN 77, Version 5.01 20 Apr 93 14:51:12
 SUBROUTINE ACCNEQ Compiling Options:
 /NO/N2/N3/N7/NA/A1/NA2/NB/NC/C1/ND/NE/NF/H/I/NK/NL/P/NQ1/R/S/NT/NV/W/NX/NZ1
 Source file Listing

Page 34

```

1411
1412      SUBROUTINE ACCNEQ (XG,YG,XP,YP)
1413 C
1414 C      Evaluate the contribution of one point to the normal equation
1415 C      required for Subroutine EIGHT. The normal equations are
1416 C      required to compute corrections to the last estimate of the
1417 C      eight transformation parameters. This is called once for each
1418 C      point.
1419 C
1420 C      XG: Calibrated X Fiducial coordinate
1421 C      YG: Calibrated Y Fiducial coordinate
1422 C      XP: Observed X Fiducial coordinate
1423 C      YP: Observed Y Fiducial coordinate
1424 C      EQN: 8 X 8 Coefficient matrix of the Normal Equation
1425 C           with the vector of constants in column 9.
1426 C
1427 C
1428      IMPLICIT DOUBLE PRECISION (A-H,O-Z)
1429      DIMENSION AM(2,2), BM(2,8), CM(2), AMM(2,2)

```

Anthropometry and Initial Conditions Photogrammetric Program

```

1430      COMMON      CALCOR(2,50),OBSCOR(2,50),EQN(8,9),DEL(8),ICH3, NFID
1431  C
1432      AM(1,1)=DEL(1)-XG*DEL(4)
1433      AM(1,2)=DEL(2)-XG*DEL(5)
1434      AM(2,1)=DEL(6)-YG*DEL(4)
1435      AM(2,2)=DEL(7)-YG*DEL(5)
1436      BM(1,1)=XP
1437      BM(1,2)=YP
1438      BM(1,3)=1.0D0
1439      BM(1,4)=-XP*XG
1440      BM(1,5)=-YP*XG
1441      BM(1,6)=0.0D0
1442      BM(1,7)=0.0D0
1443      BM(1,8)=0.0D0
1444      BM(2,1)=0.0D0
1445      BM(2,2)=0.0D0
1446      BM(2,3)=0.0D0
1447      BM(2,4)=-XP*YG
1448      BM(2,5)=-YP*YG
1449      BM(2,6)=XP
1450      BM(2,7)=YP
1451      BM(2,8)=1.0D0
1452      CM(1)=XP*AM(1,1)+YP*AM(1,2)+DEL(3)-XG
1453      CM(2)=XP*AM(2,1)+YP*AM(2,2)+DEL(8)-YG
1454  C
1455  C Form modified covariance matrix AMM
1456  C
1457      DO 10 I=1,2
1458          DO 10 J=1,2
1459              AMM(I,J)=0.0D0

```

F77L - Lahey FORTRAN 77, Version 5.01 20 Apr 93 14:51:12

Page 35

SUBROUTINE ACCNEQ Compiling Options:

/NO/N2/N3/N7/NA/A1/NA2/NB/NC/C1/ND/NE/NF/H/I/NK/NL/P/NQ1/R/S/NT/NV/W/NX/NZ1

Source file Listing

```

1460      DO 10 K=1,2
1461      AMM(I,J)=AMM(I,J)+AM(I,K)*AM(J,K)
1462 10 CONTINUE
1463      D=AMM(1,1)*AMM(2,2)-AMM(1,2)*AMM(2,1)
1464      AM(1,1)= AMM(2,2)/D
1465      AM(2,2)= AMM(1,1)/D
1466      AM(1,2)=-AMM(2,1)/D
1467      AM(2,1)= AMM(1,2)
1468  C
1469  C Form normal equations
1470  C
1471      DO 20 I=1,8
1472          DO 20 J=1,8
1473              DO 20 K=1,2
1474                  DO 20 L=1,2
1475                      EQN(I,J)=EQN(I,J)+BM(K,I)*AM(K,L)*BM(L,J)
1476 20 CONTINUE
1477      DO 30 I=1,8
1478          DO 30 K=1,2
1479              DO 30 L=1,2
1480                  EQN(I,9)=EQN(I,9)-BM(K,I)*AM(K,L)*CM(L)
1481 30 CONTINUE
1482      END

```

NAVAL BIODYNAMICS LABORATORY SOFTWARE DOCUMENTATION

F77L - Lahey FORTRAN 77, Version 5.01 20 Apr 93 14:51:12
 SUBROUTINE INVERT Compiling Options:
 /NO/N2/N3/N7/NA/A1/NA2/NB/NC/C1/ND/NE/NF/H/I/NK/NL/P/NQ1/R/S/NT/NV/W/NX/NZ1
 Source file Listing

Page 36

```

1483
1484
1485      SUBROUTINE INVERT (A,N,D)
1486 C
1487 C Find the Inverse of a Matrix by the Gaussian Elimination Method.
1488 C A: Array in which the matrix to be inverted is located.
1489 C The routine will search for the largest non-singular matrix in
1490 C the array A and invert it & return it in the same locations of A.
1491 C N: The first dimension of A. It must be a variable in the call list.
1492 C The rank of largest matrix contained in A will be returned in N.
1493 C D: The determinant of the largest non-singular matrix in A.
1494 C L & M: Vectors of dimension N used temporarily.
1495 C
1496 C
1497 C IMPLICIT DOUBLE PRECISION (A-H,O-Z)
1498 C INTRINSIC DABS
1499 C DIMENSION A(64), L(8), M(8)
1500 C
1501 C Initiate the continued product of pivots becoming the determinant.
1502 C
1503 C D=1.0D0
1504 C
1505 C Initiate the counter which contains the rank of the matrix.
1506 C
1507 C KSAVE=0
1508 C
1509 C Start the main elimination loop.
1510 C
1511 C DO 1090 K=1,N
1512 C
1513 C Search for the largest element
1514 C
1515 C L(K)=K
1516 C M(K)=K
1517 C KK=K+N*(K-1)
1518 C BIGA=A(KK)
1519 C DO 1010 I=K,N
1520 C DO 1010 J=K,N
1521 C IJ=I+N*(J-1)
1522 C IF (DABS(BIGA).GE.DABS(A(IJ))) GO TO 1010
1523 C BIGA=A(IJ)
1524 C L(K)=I
1525 C M(K)=J
1526 C 1010 CONTINUE
1527 C
1528 C Largest element of zero means the largest matrix in A is less than N.
1529 C
1530 C IF (BIGA.EQ.0) GO TO 1100
1531 C
1532 C Interchange rows

```

F77L - Lahey FORTRAN 77, Version 5.01 20 Apr 93 14:51:12
 SUBROUTINE INVERT Compiling Options:
 /NO/N2/N3/N7/NA/A1/NA2/NB/NC/C1/ND/NE/NF/H/I/NK/NL/P/NQ1/R/S/NT/NV/W/NX/NZ1
 Source file Listing

Page 37

```

1533 C
1534 C J=L(K)
1535 C KSAVE=K
1536 C IF (L(K).LE.K) GO TO 1030

```

Anthropometry and Initial Conditions Photogrammetric Program

```

1537      DO 1020 I=1,N
1538          KI=K+N*(I-1)
1539          JI=J+N*(I-1)
1540          tem=-a(ki)
1541          a(ki)=a(ji)
1542          a(ji)=tem
1543      1020      CONTINUE
1544      C
1545      C Interchange columns.
1546      C
1547      1030      I=M(K)
1548          IF (M(K).LE.K) GO TO 1050
1549          DO 1040 J=1,N
1550              JK=J+N*(K-1)
1551              JI=J+N*(I-1)
1552              tem=-a(jk)
1553              a(jk)=a(ji)
1554              a(ji)=tem
1555      1040      CONTINUE
1556      C
1557      C Divide column by minus pivot
1558      C
1559      1050      DO 1060 I=1,N
1560          IF (I.EQ.K) GO TO 1060
1561          IK=I+N*(K-1)
1562          A(IK)=A(IK)/(-A(KK))
1563      1060      CONTINUE
1564      C
1565      C Reduce matrix
1566      C
1567          DO 1070 I=1,N
1568              DO 1070 J=1,N
1569                  IF (I.EQ.K.OR.J.EQ.K) GO TO 1070
1570                  IJ=I+N*(J-1)
1571                  IK=I+N*(K-1)
1572                  KJ=K+N*(J-1)
1573                  A(IJ)=A(IK)*A(KJ)+A(IJ)
1574      1070      CONTINUE
1575      C
1576      C Divide row by pivot
1577      C
1578          DO 1080 J=1,N
1579              IF (J.EQ.K) GO TO 1080
1580              KJ=K+N*(J-1)
1581              A(KJ)=A(KJ)/A(KK)

```

F77L - Lahey FORTRAN 77, Version 5.01 20 Apr 93 14:51:12

Page 38

SUBROUTINE INVERT Compiling Options:

/NO/N2/N3/N7/NA/A1/NA2/NB/NC/C1/ND/NE/NF/H/I/NK/NL/P/NQ1/R/S/NT/NV/W/NX/NZ1

Source file Listing

```

1582      1080      CONTINUE
1583      C
1584      C Continued product of pivots
1585      C
1586          D=D*A(KK)
1587          A(KK)=1.0D0/A(KK)
1588      1090 CONTINUE
1589      C
1590      C Final row and column interchange
1591      C
1592      1100 K=KSAVE+1
1593      1110 K=K-1

```

NAVAL BIODYNAMICS LABORATORY SOFTWARE DOCUMENTATION

```

1594      IF (K.LE.0) GO TO 1150
1595 C
1596 C Restore columns.
1597 C
1598      I=L(K)
1599      IF (I.LE.K) GO TO 1130
1600      DO 1120 J=1,N
1601          JK=J+N*(K-1)
1602          JI=J+N*(I-1)
1603          tem=A(jk)
1604          A(JK)=-A(JI)
1605          A(ji)=tem
1606      1120 continue
1607 C
1608 C Restore rows.
1609 C
1610      1130 J=M(K)
1611      IF (J.LE.K) GO TO 1110
1612      DO 1140 I=1,N
1613          KI=K+N*(I-1)
1614          JI=J+N*(I-1)
1615          tem=A(ki)
1616          A(KI)=-A(JI)
1617          A(ji)=tem
1618      1140 continue
1619      GO TO 1110
1620 C
1621 C Set the rank of the matrix and return to the calling routine.
1622 C
1623      1150 RETURN
1624      END

```

F77L - Lahey FORTRAN 77, Version 5.01 20 Apr 93 14:51:12

Page 39

SUBROUTINE NEWPAG Compiling Options:
 /N0/N2/N3/N7/NA/A1/NA2/NB/NC/C1/ND/NE/NF/H/I/NK/NL/P/NQ1/R/S/NT/NV/W/NX/NZ1
 Source file Listing

```

1625
1626      SUBROUTINE NEWPAG
1627 C
1628 C Generate page titles for GIANT system, insert Form Feed whether the
1629 C FORTRAN compiler supports it or not. (Hewlett-Packard 9000 doesn't)
1630 C
1631      INTRINSIC CHAR
1632      CHARACTER FF*1, JTITLE*42
1633      COMMON /TITLEP/ JTITLE, I Page
1634 C
1635      FF=CHAR(12)
1636      I Page=I Page+1
1637      IF (I Page.GT. 0) THEN
1638          WRITE ( 8,1010) FF,JTITLE,I Page
1639          WRITE (10,1020) FF,I Page,JTITLE
1640      ENDIF
1641      1010 FORMAT(A,' NBDL H-P UNIX GIANT X-PREP :',3X,A80,3X,' Page',I5//)
1642      1020 FORMAT(A,' NBDL H-P UNIX GIANT X-PREP :',38X,' Page',I3/1X,A42/)
1643      END

```


Anthropometry and Initial Conditions Photogrammetric Program

F77L - Lahey FORTRAN 77, Version 5.01 20 Apr 93 14:51:12

Page 40

SUBROUTINE BEEP Compiling Options:

/NO/N2/N3/N7/NA/A1/NA2/NB/NC/C1/ND/NE/NF/H/I/NK/NL/P/NQ1/R/S/NT/NV/W/NX/NZ1

Source file Listing

```
1644
1645     SUBROUTINE BEEP
1646 C
1647 C   This routine causes a "beep" sound when called. (ANSI terminals)
1648 C
1649     CHARACTER*1 BEEEP
1650     INTRINSIC CHAR
1651     BEEEP=CHAR(7)
1652     WRITE (*,'(1X,A1)') BEEEP
1653     END
```

F77L - Lahey FORTRAN 77, Version 5.01 20 Apr 93 14:51:12

Page 41

SUBROUTINE CLEAR Compiling Options:

/NO/N2/N3/N7/NA/A1/NA2/NB/NC/C1/ND/NE/NF/H/I/NK/NL/P/NQ1/R/S/NT/NV/W/NX/NZ1

Source file Listing

```
1654
1655     SUBROUTINE CLEAR
1656     CALL CLR
1657     CALL TOPLFT
1658     CALL CURDWN (8)
1659     END
```

F77L - Lahey FORTRAN 77, Version 5.01 20 Apr 93 14:51:12

Page 42

SUBROUTINE CLR Compiling Options:

/NO/N2/N3/N7/NA/A1/NA2/NB/NC/C1/ND/NE/NF/H/I/NK/NL/P/NQ1/R/S/NT/NV/W/NX/NZ1

Source file Listing

```
1660
1661     SUBROUTINE CLR
1662 C
1663 C   This routine erases the screen and the cursor goes to the home position
1664 C (ANSI)   STRING = ESC I 2 J
1665 C
1666     CHARACTER*1 ESC,BKT,TWO,J,STRING*4
1667     INTRINSIC CHAR
1668     ESC=CHAR(27)
1669     BKT=CHAR(91)
1670     TWO=CHAR(50)
1671     J=CHAR(74)
1672     STRING=ESC//BKT//TWO//J
1673     WRITE (*,'(1X,A4)') STRING
1674     END
```

F77L - Lahey FORTRAN 77, Version 5.01 20 Apr 93 14:51:12

Page 43

SUBROUTINE CURDWN Compiling Options:

/NO/N2/N3/N7/NA/A1/NA2/NB/NC/C1/ND/NE/NF/H/I/NK/NL/P/NQ1/R/S/NT/NV/W/NX/NZ1

Source file Listing

```
1675
1676     SUBROUTINE CURDWN (IROW)
1677 C
1678 C   This routine moves the cursor down IROW lines without changing column
1679 C (ignored if the cursor is already at the bottom of the screen)
1680 C (ANSI)
```

NAVAL BIODYNAMICS LABORATORY SOFTWARE DOCUMENTATION

```

1681 C
1682 CHARACTER*1 ESC,BKT,B
1683 CHARACTER*2 ESCBKT
1684 INTRINSIC CHAR
1685 ESC=CHAR(27)
1686 BKT=CHAR(91)
1687 ESCBKT=ESC//BKT
1688 B=CHAR(66)
1689 IF (IROW.LT.10) WRITE (*,'(1X,A2,I1,A1,/)' ) ESCBKT,IROW,B
1690 IF (IROW.GE.10) WRITE (*,'(1X,A2,I2,A1,/)' ) ESCBKT,IROW,B
1691 END

```

F77L - Lahey FORTRAN 77, Version 5.01 20 Apr 93 14:51:12

Page 44

SUBROUTINE TOPLFT Compiling Options:
 /NO/N2/N3/N7/NA/A1/NA2/NB/NC/C1/ND/NE/NF/H/I/NK/NL/P/NQ1/R/S/NT/NV/W/NX/NZ1
 Source file Listing

```

1692
1693 SUBROUTINE TOPLFT
1694 C
1695 C Move the cursor to the top left of the scrolling region.(ANSI)
1696 C
1697 CHARACTER*1 ESCAPE,L_BRACKET,SEMICOLON,H
1698 CHARACTER*2 ESCBKT
1699 INTRINSIC CHAR
1700 ESCAPE=CHAR(27)
1701 L_BRACKET=CHAR(91)
1702 ESCBKT=ESCAPE//L_BRACKET
1703 SEMICOLON=CHAR(59)
1704 H=CHAR(72)
1705 N=1
1706 WRITE (*,'(1X,A2,I1,A1,I1,A1,/)' ) ESCBKT,N,SEMICOLON,N,H
1707 END

```

Anthropometry and Initial Conditions Photogrammetric Program

NPREP Program listing

F77L - Lahey FORTRAN 77, Version 5.00 19 Mar 92 14:56:42
PROGRAM DIGITIZE_GIANT_IMAGE_DATA_FILE Compiling Options:
/NO/N2/N3/N7/NA/A1/NA2/NB/NC/C1/ND/NE/NF/H/I/NK/NL/P/NQ1/R/S/NT/NV/W/NX/NZ1
Source file Listing

Page 1

```
1      PROGRAM Digitize_Giant_Image_Data_File
2      cccc
3      c c      Altek digitizer 4-button key control meanings:
4      c c      #2:RED = error-backup
5      c c      #4:BLUE=abort photo      #1:YELLOW=missing
6      c c      #3:GREEN=fiducial or data point
7      cccc
8      common /title/ title, page, out, img, dig
9      character*74 title, irun*6, fn*12, day*8
10     integer page, out, img, dig
11     call SYSTEM ('cls')
12     page=0
13     out=1
14     img=2
15     dig=3
16     write (*,*) 'Enter COMM Port number: '
17     read (*,*) icmm
18     icmm=icmm+48
19     call SYSTEM ('mode com'//char(icmm)//':9600,o,7,2')
20     open (dig,file = 'com'//char(icmm), access='transparent')
21     call DATE (day)
22  c
23     write(*,*)
24     write(*,*)'Enter 0 for initial conditions'
25     write(*,*)'Enter 1 for head anthropometry'
26     write(*,*)'Enter 2 for body anthropometry'
27     write(*,*)
28     read (*,*)ians
29     if(ians==0)then
30 1      write (*,*)
31      write (*,*)'Enter RUN number (A6): '
32      read (*,*) irun
33      write(*,*)
34      do i=1,6
35          if(irun(i:i)==' ')go to 1
36      enddo
37      open (out,file =irun//'.pr.out', status='new')
38      open (img,file =irun//'.im.dat', status='new')
39      write (title, "(' Initial Conditions for Run # ',a6,24x,' Date:'
40              ,a8)") irun, day
41      call HEADS(ians)
42     else
43         write (*,*) 'Enter HRV number: '
44         read (*,*) ihrv
45         write (*,*)
46         if(ians==1)then
47             write (*,*) 'Default ear offsets are: 5.420", 5.420". ok?'
48             write (*,*) 'Hit RETURN to accept. Any other key to change'
49             write (*,*)
50             i=ixkey()
51             if (i/=13) then
```

NAVAL BIODYNAMICS LABORATORY SOFTWARE DOCUMENTATION

F77L - Lahey FORTRAN 77, Version 5.00 19 Mar 92 14:56:42
 PROGRAM DIGITIZE_GIANT_IMAGE_DATA_FILE Compiling Options:
 /NO/N2/N3/N7/NA/A1/NA2/NB/NC/C1/ND/NE/NF/H/I/NK/NL/P/NQ1/R/S/NT/NV/W/NX/NZ1
 Source file Listing

Page 2

```

52      write (*,*) 'Enter left & right ear offsets: '
53      read (*,*) ol, or
54      write (*,*)
55      else
56      ol=5.420
57      or=5.420
58      endif
59      write (fn, '(i4.4, 'head.out')') ihrv
60      open (out, file =fn, status='new')
61      write (fn, '(i4.4, 'himg.dat')') iher
62      open (img, file =fn, status='new')
63      write (img, *) ol, or
64      write (title, '( Head Anthropometry for HRV # ', i5.5,
65      23x, ' Date: ', a8)') iher, day
66      call HEADS(ians)
67      elseif(ians==2) then
68      write (fn, '(i4.4, 'body.out')') iher
69      open (out, file =fn, status='new')
70      write (fn, '(i4.4, 'bimg.dat')') iher
71      open (img, file =fn, status='new')
72      write (title, '( Body Anthropometry for HRV # ', i5.5,
73      23x, ' Date: ', a8)') iher, day
74      call BODY
75      endif
76      endif
77      write (*,*)
78      end
  
```

F77L - Lahey FORTRAN 77, Version 5.00 19 Mar 92 14:56:42
 SUBROUTINE HEADS Compiling Options:
 /NO/N2/N3/N7/NA/A1/NA2/NB/NC/C1/ND/NE/NF/H/I/NK/NL/P/NQ1/R/S/NT/NV/W/NX/NZ1
 Source file Listing

Page 3

```

79
80      SUBROUTINE HEADS(ians)
81      c      ians=0      Digitize Initial Conditions For Accelerator Run
82      c      ians=1      Digitization Of Head Anthropometry
83      c
84      c      Revised January 25, 1992 by D. Francis
85      c
86      implicit real*8 (a-h,o-z)
87      common calcor(2,50), obscor(2,50), eqn(8,9), del(8), ich3, nfid
88      common /title/ title, page, out, img, dig
89      character*74 title
90      integer      page, out, img, dig, icm(6)
91      character      data*17
92      character*8 ifram(14), ilab(12), icon(35), itarg(40)
93      integer      ibutt, ifid, ix, iy
94      real*8      xy(2,33), calfid(2,4,8), foc(8), fk(4,8), xo(2,8)
95      data ilab /' top 1', ' top 2', ' top 3', ' rt 1',
96      ' rt 2', ' rt 3', ' bot 1', ' bot 2',
97      ' bot 3', ' lft 1', ' lft 2', ' lft 3'/
98      data icon /' a', ' b', ' c', ' d',
99      ' e', ' f', ' g', ' h',
100      ' i', ' j', ' k',
101      ' rtc1', ' rtc2', ' rtc3', ' rtc4',
102      ' rtc5', ' rtc6', ' rtc7', ' rtc8',
103      ' cen1', ' cen2', ' cen3', ' cen4',
104      ' cen5', ' cen6', ' cen7', ' cen8',
  
```

Anthropometry and Initial Conditions Photogrammetric Program

```

105      , lfc1', lfc2', lfc3', lfc4',
106      , lfc5', lfc6', lfc7', lfc8',
107      data itarg / m_r1', m_r4', m_t1', m_t4',
108      , m_b1', m_b4', m_l1', m_l4', t_r1',
109      , t_r4', t_c1', t_c4', t_l1', t_l4',
110      , mtar01', mtar03', mtar06', mtar07', mtar08',
111      , mtar09', mtar11', htar02', htar03', htar04',
112      , htar11', htar13', htar14',
113
114      , rtp', ctp', ltp', ron', lon',
115      , ear1-r', ear2-r', ear3-r', ear4-r',
116      , ear1-l', ear2-l', ear3-l', ear4-l',
117      data ifram / #1', #2', #3',
118      , #4', #5', #6',
119      , #1-580', #2-736', #3-674', #4-623',
120      , #5-591', #6-806', #7-074', #8-799',
121      data foc / -55.003d0, -55.003d0, -55.005d0, -55.004d0,
122      , -55.002d0, -55.005d0, -55.001d0, -55.004d0,
123      data calfid/18.1126, -12.1263, 18.1047, 12.1259, -18.1199, 12.1311,
124      , -18.1053, -12.1263, 18.1162, -12.1319, 18.1186, 12.1364,
125      , -18.1264, 12.1387, -18.1118, -12.1319,
126      , 18.1101, 12.1239, -18.1170, 12.1277, -18.1071, -12.1219,
127      , 18.1023, -12.1271, 18.1098, 12.1178, -18.1089, 12.1315,
128      , -18.1237, -12.1271, 18.1302, -12.1250, 18.1230, 12.1361,
129      , -18.1178, 12.1167, -18.1064, -12.1250, 18.1055, -12.1224,
130      , 18.1109, 12.1266, -18.1340, 12.1414, -18.1046, -12.1224,
131      , 18.1208, -12.1289, 18.1323, 12.1450, -18.1405, 12.1421,

```

F77L - Lahey FORTRAN 77, Version 5.00 19 Mar 92 14:56:42

Page 4

SUBROUTINE HEADS Compiling Options:

/NO/N2/N3/N7/NA/A1/NA2/NB/NC/C1/ND/NE/NF/H/I/NK/NL/P/NQ1/R/S/NT/NV/W/NX/NZ1

Source file Listing

```

132      , -18.1083, -12.1289, 18.0867, -12.1120, 18.1023, 12.1168,
133      , -18.0823, 12.1091, -18.0953, -12.1120/
134      c Radial Lens Distortion Coefficients FK0, FK1, FK2, FK3
135      data fk /1.924312d-04, -2.839673d-06, 1.940416d-08, -4.715753d-11,
136      , 6.467923d-04, -1.301398d-05, 7.699424d-08, -1.413951d-10,
137      , 5.920576d-04, -1.120280d-05, 6.877133d-08, -1.358581d-10,
138      , 7.242229d-04, -1.395773d-05, 8.152970d-08, -1.488803d-10,
139      , 3.126069d-04, -7.650029d-06, 5.678321d-08, -1.212948d-10,
140      , 7.208347d-04, -1.328443d-05, 7.942249d-08, -1.541224d-10,
141      , 2.566426d-05, -8.466813d-07, 1.618407d-08, -5.114144d-11,
142      , 6.696901d-04, -1.176637d-05, 6.149184d-08, -1.050377d-10/
143      c Offsets
144      data xo / -0.005, -0.022, 0.027, 0.088, 0.037, 0.088,
145      , -0.056, 0.132, 0.013, 0.122, 0.045, 0.036,
146      , -0.005, -0.022, 0.019, 0.140/
147      c Cameras assigned to each photo number
148      data icm /1, 2, 3, 4, 5, 6/
149      ncont=35
150      c 27 for initial conditions (ians=0) & 13 for head anthro (ians=1)
151      jt=27*ians
152      ntarg=27
153      if(ians==1) ntarg = 13
154      units=.001d0
155      sdx = .055d0
156      sdy = .055d0
157      c
158      1 write (*,*) ' Enter Photo # (1-6, 0 when finished) '
159      read (*,*) ipho
160      call CLEAR
161      if(ipho==0) go to 999
162      c
163      icam=icm(ipho)
164      focal= foc(icam)

```

NAVAL BIODYNAMICS LABORATORY SOFTWARE DOCUMENTATION

```

165      call NEWPAG
166      write (out,2) ifram(ipho)
167  2    format (16x,'Calibrated Fiducial Coordinates of Frame ',a8//
168        .      26x,'Fid', 9x,'X', 12x,'Y')
169  c
170  c Write Calibrated Fiducial Coordinates
171  c
172      do ifid=1, 4
173          write (out,4) ifid,calfid(1,ifid,icam),calfid(2,ifid,icam)
174  4    format (25x,i4,5x,f8.3,5x,f8.3)
175      enddo
176      write (out,8) focal, xo(1,icam),xo(2,icam)
177  8    format (/sp,' Calibrated Focal Length = ',f9.3,' mm. Xoff= ',
178        .      f7.3,' mm. Yoff= ',f7.3,' mm.')
179      write (out,10) (fk(i,icam), i=1,4)
180  10   format (///31x,sp,'Lens Distortion'///31x,'Radial Parameters'//11x
181        .      'K0='d15.8d2,' K1='d15.8d2,' K2='d15.8d2/31x'K3='d15.8d2//)
182  c
183  c Read & Write Frame ID
184  c

```

F77L - Lahey FORTRAN 77, Version 5.00 19 Mar 92 14:56:42

Page 5

SUBROUTINE HEADS Compiling Options:

/NO/N2/N3/N7/NA/A1/NA2/NB/NC/C1/ND/NE/NF/H/1/NK/NL/P/NQ1/R/S/NT/NV/W/NX/NZ1

Source file Listing

```

185      write (img,12) ifram(ipho), focal, sdx, sdy,ifram(icam+6)
186  12   format (a8,2x,sp,f10.3:,ss,2(f10.3),a8,2x)
187      call NEWPAG
188      write (out,14) ifram(ipho)
189  14   format (20x,'Fiducial Measurements of Frame ',a8// 24x,'ID',12x,
190        .      'Measured'/37x,'X',14x,'Y')
191
192  c *****
193  c Digitize edges:
194      ifid=1
195  20   write (*,*) 'Enter: ', ilab(ifid)
196      read (dig) data
197      write (*,*) char(7)
198  c
199  c DECODE data from CHARACTER to INTEGER
200      if (ichar(data(1:1)) < 32) data(1:16) = data(2:17)
201      read (data, 50) ibutt,ix,iy
202  50   format (i1,1x,i6,1x,i6)
203  c
204  c Interpret action to take based on which button was pressed:
205      if (ibutt == 3) then          ! good
206          xy(1,ifid)=ix*units
207          xy(2,ifid)=iy*units
208          ifid=ifid+1
209      elseif (ibutt == 2) then      ! error - backup
210          ifid=ifid-1
211          write (*,*) 'Backing up one to ',ilab(ifid)
212          write (*,*) char(7),char(7)
213      else
214          write (*,*) 'Not an option. Redo'
215      endif
216      if (ifid <= 12) go to 20
217  c
218  c Find the fiducials from these edges
219      call FID(XY)                  ! 12 in & 4 out
220      nfid=4
221  c
222  c Store observed (digitized) coordinates
223      do ifid=1,4

```

Anthropometry and Initial Conditions Photogrammetric Program

```

224      do i=1,2
225          obscor(i,ifid)=xy(i,ifid)
226          calcor(i,ifid)=calfid(i,ifid,icam)
227      enddo
228      write (out,64) ifid,xy(1,ifid),xy(2,ifid)
229 64      format (22x,i4,2f15.3)
230      enddo
231  c
232  c Compute the 4-Parameter Check Transformation.
233  c
234      ich3=0
235      call FOURP
236      write (*,*)' 4-Parameter Check Transformation'
```

F77L - Lahey FORTRAN 77, Version 5.00 19 Mar 92 14:56:42

Page 6

SUBROUTINE HEADS Compiling Options:

/NO/N2/N3/N7/NA/A1/NA2/NB/NC/C1/ND/NE/NF/H/I/NK/NL/P/NQ1/R/S/NT/NV/W/NX/NZ1

Source file Listing

```

237      rmsx=0.
238      rmsy=0.
239      do i=1,4
240          x=obscor(1,i)
241          y=obscor(2,i)
242          dn=(x*del(4)+y*del(5)+1.0)
243          xt=(x*del(1)+y*del(2)+del(3))/dn-calcor(1,i)
244          yt=(x*del(6)+y*del(7)+del(8))/dn-calcor(2,i)
245          write (*,64) i,xt,yt
246          rmsx=rmsx+xt*xt
247          rmsy=rmsy+yt*yt
248      enddo
249      rmsx3=dsqrt(rmsx/nfid)
250      rmsy3=dsqrt(rmsy/nfid)
251      write (*, '( ' rms= ',2f7.3/ )')rmsx3, rmsy3
252      write (*,*)'8-Parameter Transformation'
253      rmsx=0.
254      rmsy=0.
255  c
256  c Compute the Multi-Parameter Transformation.
257      call EIGHTP
258      write (out,66)
259 66      format (//17x,'8-Parameter Residuals of the Fiducial Coordinates'/
260              / 23x, 'Fid', 11x, 'X', 14x, 'Y')
261  c
262  c Compute Residuals For the Fiducial Coordinates
263  c
264      do i=1,4
265          x=obscor(1,i)
266          y=obscor(2,i)
267          dn=(x*del(4)+y*del(5)+1.0)
268          xt=(x*del(1)+y*del(2)+del(3))/dn-calcor(1,i)
269          yt=(x*del(6)+y*del(7)+del(8))/dn-calcor(2,i)
270          write (out,64) i,xt,yt
271          write (*,64) i,xt,yt
272          rmsx=rmsx+xt*xt
273          rmsy=rmsy+yt*yt
274      enddo
275      rmsx=dsqrt(rmsx/4)
276      rmsy=dsqrt(rmsy/4)
277      write (*, '( ' rms= ',2f7.3/ )')rmsx, rmsy
278      write (out, 68)rmsx, rmsy, rmsx3, rmsy3, del
279 68      format(/23x,'Rms',2f15.3/23x,'Rms(check)',f8.3, f15.3/
280              /25x,'Transformation Parameters Are:'/13x,2f11.6,f11.4,
281              2f11.6/13x,2f11.6,f11.4)
282      call NEWPAG
283      write (out,70)ipho
```

NAVAL BIODYNAMICS LABORATORY SOFTWARE DOCUMENTATION

```

284 70  format (/24x,'Plate Coordinates for Frame ',i4//18x,'ID',11x,
285      'Measured',13x,'Adjusted'/30x,'X',9x,'Y',10x,'X',9x,'Y')
286      write (out,*)'      Control:'
287      pause
288 c
289 c*****

```

F77L - Lahey FORTRAN 77, Version 5.00 19 Mar 92 14:56:42

Page 7

SUBROUTINE HEADS Compiling Options:

/N0/N2/N3/N7/NA/A1/NA2/NB/NC/C1/ND/NE/NF/H/I/NK/NL/P/NQ1/R/S/NT/NV/W/NX/NZ1

Source file Listing

```

290 c Digitize the control points for this photo
291     icon=1
292 100 write(*,*) 'Enter: ', icon(icon)
293     read (dig) data
294     write (*,*) char(7)
295 c
296 c DECODE data from CHARACTER to INTEGER
297     if (ichar(data(1:1)) < 32) data(1:16) = data(2:17)
298     read (data, 50) ibutt,ix,iy
299 c
300 c Interpret action to take based on which button was pressed:
301     if (ibutt == 4) then
302         write (*,*) 'Abort requested. Restart photo.'
303         write (*,*) char(7),char(7)
304         write (out,*) 'Abort requested*****'
305         write (img,*) 'Abort requested*****'
306         go to 1
307     elseif (ibutt == 3) then
308         xy(1,icon)=ix*units
309         xy(2,icon)=iy*units
310         icon=icon+1
311     elseif (ibutt == 2) then
312         icon=icon-1
313         write (*,*) 'Backing up one to ',icon(icon)
314         write (*,*) char(7),char(7)
315     elseif (ibutt == 1) then
316         xy(1,icon)=-1.
317         xy(2,icon)=-1.
318         write (*,*) '      missing ', icon(icon)
319         write (*,*)
320         icon=icon+1
321     else
322         write (*,*) 'Not an option. Redo'
323     endif
324     if (icon <= ncont) go to 100
325 c
326     icon=0
327     do k=1,ncont      ! process control points
328         icon=icon+1
329 110     if (icon>ncont) go to 150
330         if (xy(1,icon)<=0) then
331             icon=icon+1
332             go to 110
333         endif
334         x=xy(1,icon)
335         y=xy(2,icon)
336 c Correct Measured Coordinates for Film Shrinkage & Offset
337         dn=(x*del(4)+y*del(5)+1.0)
338         xt=(x*del(1)+y*del(2)+del(3))/dn-xo(1,icam)
339         yt=(x*del(6)+y*del(7)+del(8))/dn-xo(2,icam)
340 c Correct for Radial Lens Distortion:
341         rt2=(xt**2+yt**2)

```


Anthropometry and Initial Conditions Photogrammetric Program

F77L - Lahey FORTRAN 77, Version 5.00 19 Mar 92 14:56:42

Page 8

SUBROUTINE HEADS Compiling Options:

/NO/N2/N3/N7/NA/A1/NA2/NB/NC/C1/ND/NE/NF/H/I/NK/NL/P/NQ1/R/S/NT/NV/W/NX/NZ1

Source file Listing

```
342      rt4=rt2*rt2
343      rt6=rt4*rt2
344      c1=fk(2,icam)*rt2+fk(3,icam)*rt4+fk(4,icam)*rt6+1.d0+fk(1,icam)
345      xt=c1*xt
346      yt=c1*yt
347  c
348      write (out,112) icon(icon),x,y,xt,yt
349  112      format (14x,a8,2x,2f10.3,1x,2f10.3)
350      write (img,114) icon(icon),xt,yt,ifram(iphon)
351  114      format (a8,2x,2f10.4,15x,'Photo ',a8)
352      enddo
353  c
354  150 write (out,*)'      Targets:'
355      pause
356
357  c*****
358  c Digitize the target points for this photo
359      itar=1
360  200 write(*,*) 'Enter: ', itarg(itarg+jt)
361      read (dig) data
362      write (*,*) char(7)
363  c
364  c DECODE data from CHARACTER to INTEGER
365      if (ichar(data(1:1)) < 32) data(1:16) = data(2:17)
366      read (data, 50) ibutt,ix,iy
367  c
368  c Interpret action to take based on which button was pressed:
369      if (ibutt == 4) then
370          write (*,*) 'Abort requested. Restart photo.'
371          write (*,*) char(7),char(7)
372          write (out,*) 'Abort requested*****'
373          write (img,*) 'Abort requested*****'
374          go to 1
375      elseif (ibutt == 3) then
376          xy(1,itar)=ix*units
377          xy(2,itar)=iy*units
378          itar=itar+1
379      elseif (ibutt == 2) then
380          itar=itar-1
381          write (*,*) 'Backing up one to ',itarg(itarg+jt)
382          write (*,*) char(7),char(7)
383      elseif (ibutt == 1) then
384          xy(1,itar)=-1.
385          xy(2,itar)=-1.
386          write (*,*) '      missing ', itarg(itarg+jt)
387          write (*,*)
388          itar=itar+1
389      else
390          write (*,*) 'Not an option. Redo'
391      endif
392      if (itar <= ntarg) go to 200
393  c
394      itar=0
```

NAVAL BIODYNAMICS LABORATORY SOFTWARE DOCUMENTATION

F77L - Lahey FORTRAN 77, Version 5.00 19 Mar 92 14:56:42

Page 9

SUBROUTINE HEADS Compiling Options:

/NO/N2/N3/N7/NA/A1/NA2/NB/NC/C1/ND/NE/NF/H/I/NK/NL/P/NQ1/R/S/NT/NV/W/NX/NZ1

Source file Listing

```

395      do k=1,ntarg      ! process target points
396          itar=itar+1
397      210      if (itar>ntarg) go to 250
398          if (xy(1,itar)<=0) then
399              itar=itar+1
400              go to 210
401          endif
402          x=xy(1,itar)
403          y=xy(2,itar)
404      c  Correct Measured Coordinates for Film Shrinkage & Offset
405          dn=(x*del(4)+y*del(5)+1.0)
406          xt=(x*del(1)+y*del(2)+del(3))/dn-xo(1,icam)
407          yt=(x*del(6)+y*del(7)+del(8))/dn-xo(2,icam)
408      c  Correct for Radial Lens Distortion:
409          rt2=(xt**2+yt**2)
410          rt4=rt2*rt2
411          rt6=rt4*rt2
412          c1=fk(2,icam)*rt2+fk(3,icam)*rt4+fk(4,icam)*rt6+1.d0+fk(1,icam)
413          xt=c1*xt
414          yt=c1*yt
415      c
416          write (out,112) itarg(itar+jt),x,y,xt,yt
417          write (img,114) itarg(itar+jt),xt,yt,ifram(ipho)
418      enddo
419      c
420      250 write (img,'(A8)') '*****'
421      c
422          go to 1
423      c
424      999 write (out,*)char(12)
425      END

```

F77L - Lahey FORTRAN 77, Version 5.00 19 Mar 92 14:56:42

Page 10

SUBROUTINE BODY Compiling Options:

/NO/N2/N3/N7/NA/A1/NA2/NB/NC/C1/ND/NE/NF/H/I/NK/NL/P/NQ1/R/S/NT/NV/W/NX/NZ1

Source file Listing

```

426      c-----
427      SUBROUTINE BODY
428      c          XRay Digitization Of Body Anthropometry
429      implicit real*8 (a-h,o-z)
430      common calcor(2,50),obscor(2,50),eqn(8,9),del(8),ich3, nfid
431      common /title/ title, page, out, img, dig
432      character*74 title
433      integer page, out, img, dig
434      character data*17
435      character*8 ifram(4),idbod(16), idpt
436      integer ibutt, ifid, ix, iy, idfd(10)
437      real*8 xy(2,21), calfid(2,10,2)
438      logical iflag
439      data ifram /'LfEyLfSh','RtEyLfSh','LfEyRtSh','RtEyRtSh'/
440      data idbod /'Origin','Rib_Lf','Rib_Rt','SpineTop','SpineBot',
441      .          'spine_bb','sternum','lf_shold','rt_shold',
442      .          'ltp','rtp','ctp','lneckT','lneckB','rneckT','rneckB'/
443      data calfid/-190.190,-147.150,-77.030,-160.380, 77.220,-158.830,
444      .          192.510,-146.442,-190.060, 5.760, 191.570, 5.990,
445      .          -190.490, 157.980,-75.380, 146.070, 77.730, 147.920,
446      .          191.520, 158.540,-193.950,-148.160,-80.380,-162.380,
447      .          75.670,-164.310, 191.214,-148.961,-193.920, 5.010,
448      .          192.310, 4.800,-193.010, 159.210,-80.050, 147.600,

```

Anthropometry and Initial Conditions Photogrammetric Program

```

449      .          75.390, 144.880, 192.720, 158.520/
450 c
451 c Read order of transformation
452   write (*,*) ' Enter number of parameters for shrinkage fit: '
453   read (*,*) iopt1
454   write (*,*)
455   if (iopt1>6)iopt1=8
456   ich3s=0
457   if (iopt1<=3) then
458       ich3s=1
459       iopt1=3
460   end if
461   nbod=16
462   units=.0254d0
463   sdx = 1.0d0
464   sdy = 1.0d0
465 c
466 1 write (*,*) ' Enter 0 when finished'
467   write (*,*) ' Enter 1 if: Left Eye View---Left Shoulder to Plate'
468   write (*,*) ' Enter 2 if: Right Eye View---Left Shoulder to Plate'
469   write (*,*) ' Enter 3 if: Left Eye View--Right Shoulder to Plate'
470   write (*,*) ' Enter 4 if: Right Eye View--Right Shoulder to Plate'
471   write (*,*)
472   read (*,*) ians
473   if(ians==0) go to 999
474 c
475   call CLEAR
476 c
477   focal= -889.0d0

```

F77L - Lahey FORTRAN 77, Version 5.00 19 Mar 92 14:56:42

Page 11

SUBROUTINE BODY Compiling Options:

/NO/N2/N3/N7/NA/A1/NA2/NB/NC/C1/ND/NE/NF/H/I/NK/NL/P/NQ1/R/S/NT/NV/W/NX/NZ1

Source file Listing

```

478   call NEWPAG
479   write (out,2400)ifram(ians)
480 c
481 c Write Calibrated Fiducial Coordinates
482 c
483   jfid=2
484   do ifid=1, 10
485       write (out,2420) ifid,calfid(1,ifid,jfid),calfid(2,ifid,jfid)
486   enddo
487 c
488 c Read & Write Frame ID
489 c
490   write (img,1516) ifram(ians), focal, sdx, sdy
491   call NEWPAG
492   write (out,2380) ifram(ians)
493 c*****
494 c Start major loop for digitizing x-rays:
495   iflag=.true.
496   IFID=1
497 10 read (dig) DATA
498   write (*,*) CHAR(7)
499 c
500 c DECODE data from CHARACTER to INTEGER
501 c
502   if (ichar ( data(1:1) ) < 32) data(1:16) = data(2:17)
503   read (DATA, 20) IBUTT,IX,IY
504 20 FORMAT (I1,1X,I6,1X,I6)
505 c
506 c Interpret action to take based on which button was pressed:
507   if (ibutt == 3) then

```

NAVAL BIODYNAMICS LABORATORY SOFTWARE DOCUMENTATION

```

508      xy(1,ifid)=ix*units
509      xy(2,ifid)=iy*units
510      write (*,30) ' FIDUCIAL',ifid,xy(1,ifid),xy(2,ifid)
511 30    format (a,1x,i3,2x,f8.4,2x,f8.4)
512      if(iflag)then
513          isavex=ix
514          isavey=iy
515          iflag=.false.
516      endif
517      ifid=ifid+1
518  elseif (ibutt == 2) then
519      ifid=ifid-1
520      write (*,*) 'Backing up one to FIDUCIAL # ',ifid
521      write (*,*) char(7),char(7)
522  elseif (ibutt == 1) then
523      xy(1,ifid)=-1.
524      xy(2,ifid)=-1.
525      write (*,*) '      MISSING ', ifid
526      ifid=ifid+1
527  else
528      write (*,*) 'Not an option. Redo'
529  endif

```

F77L - Lahey FORTRAN 77, Version 5.00 19 Mar 92 14:56:42

Page 12

SUBROUTINE BODY Compiling Options:

/NO/N2/N3/N7/NA/A1/NA2/NB/NC/C1/ND/NE/NF/H/I/NK/NL/P/NQ1/R/S/NT/NV/W/NX/NZ1

Source file Listing

```

530      if (ifid <= 10) go to 10
531 c
532      ifid=0
533      do k=1,10
534 c
535 c      Store observed (digitized) coordinates
536 c
537      ifid=ifid+1
538 80    if (ifid>10) go to 210
539      if (xy(1,ifid)<=0) then
540          ifid=ifid+1
541          go to 80
542      endif
543      kk=ifid
544      do i=1,2
545          obscor(i,ifid)=xy(i,ifid)
546          calcor(i,ifid)=calfid(i,kk,jfid)
547      enddo
548      idfd(k)=kk
549      write (out,64) kk,xy(1,ifid),xy(2,ifid)
550 64    format (22x,i4,2f15.3)
551      enddo
552 c
553 c      Compute the 3-Parameter Check Transformation.
554 c
555 210    nfid=k-1
556      ich3=1
557      call FOURP
558      write (*,*)' 3-Parameter Check Transformation'
559      rmsx=0.
560      rmsy=0.
561      do i=1,nfid
562          x=obscor(1,i)
563          y=obscor(2,i)
564          den=(x*del(4)+y*del(5)+1.0)
565          xt=(x*del(1)+y*del(2)+del(3))/den-calcor(1,i)

```

Anthropometry and Initial Conditions Photogrammetric Program

```

566      yt=(x*del(6)+y*del(7)+del(8))/den-calcor(2,i)
567      kk=idfd(i)
568      write ( *,2560) kk,xt,yt
569      rmsx=rmsx+xt*xt
570      rmsy=rmsy+yt*yt
571      enddo
572      rmsx3=dsqrt(rmsx/nfid)
573      rmsy3=dsqrt(rmsy/nfid)
574      write (*,230)rmsx, rmsy
575 230 format (' rms= ',2f7.3)
576      write (*,*)
577      write (*,*)iopt1,'-Parameter Transformation'
578      rmsx=0.
579      rmsy=0.
580  c
581  c Compute the Multi-Parameter Transformation.
582      ich3=ich3s

```

F77L - Lahey FORTRAN 77, Version 5.00 19 Mar 92 14:56:42

Page 13

SUBROUTINE BODY Compiling Options:

/NO/N2/N3/N7/NA/A1/NA2/NB/NC/C1/ND/NE/NF/H/I/NK/NL/P/NQ1/R/S/NT/NV/W/NX/NZ1

Source file Listing

```

583      if (iopt1<=5) call FOURP
584      if (iopt1==5) call FIVEP
585      if (iopt1==6) call SIXP
586      if (iopt1==8) call EIGHTP
587      write (out,2550) iopt1
588  c
589  c Compute Residuals For the Fiducial Coordinates
590  c
591      do i=1,nfid
592      x=obscor(1,i)
593      y=obscor(2,i)
594      dn=(x*del(4)+y*del(5)+1.0)
595      xt=(x*del(1)+y*del(2)+del(3))/dn-calcor(1,i)
596      yt=(x*del(6)+y*del(7)+del(8))/dn-calcor(2,i)
597      kk=idfd(i)
598      write (out,2560) kk,xt,yt
599      write ( *,2560) kk,xt,yt
600      rmsx=rmsx+xt*xt
601      rmsy=rmsy+yt*yt
602      enddo
603      rmsx=dsqrt(rmsx/nfid)
604      rmsy=dsqrt(rmsy/nfid)
605      write (*,230)rmsx, rmsy
606      write(out, 2545)rmsx, rmsy, rmsx3, rmsy3, del
607 2545 format(/23x,'Rms',2f15.3/23x,'Rms(check)',f8.3, f15.3/
608      . /25x,'Transformation Parameters Are:'/13x,2f11.6,f11.4,
609      . 2f11.6/13x,2f11.6,f11.4)
610      call NEWPAG
611      write (out,2575)ifram(ians)
612      pause
613  c*****
614 500 ibod=1
615 550 read (dig) data
616      write (*,*) CHAR(7)
617  c
618  c DECODE data from CHARACTER to INTEGER
619  c
620      if (ichar ( data(1:1) ) < 32) data(1:16) = data(2:17)
621      read (data, 20) ibutt,ix,iy
622  c
623  c Interpret action to take based on which button was pressed:

```

NAVAL BIODYNAMICS LABORATORY SOFTWARE DOCUMENTATION

```

624      if (ibutt == 4) then
625          write (*,*) 'Abort requested. Restart photo.'
626          write (*,*) char(7),char(7)
627          write (out,*) 'Abort requested*****'
628          write (img,*) 'Abort requested*****'
629          go to 1
630      elseif (ibutt == 3) then
631          xy(1,ibod)=IX*units
632          xy(2,ibod)=IY*units
633          write (*,555)idbod(ibod),xy(1,ibod),xy(2,ibod)
634      555      format (a10,2x,f8.4,2x,f8.4)

```

F77L - Lahey FORTRAN 77, Version 5.00 19 Mar 92 14:56:42

Page 14

SUBROUTINE BODY Compiling Options:

/NO/N2/N3/N7/NA/A1/NA2/NB/NC/C1/ND/NE/NF/H/I/NK /NL/P/NQ1/R/S/NT/NV/W/NX/NZ1

Source file Listing

```

635          ibod=ibod+1
636      elseif (ibutt == 2) then
637          ibod=ibod-1
638          write (*,*) 'Backing up one to ', idbod(ibod)
639          WRITE (*,*) char(7),char(7)
640      elseif (ibutt == 1) then
641          xy(1,ibod)=-1.
642          xy(2,ibod)=-1.
643          write (*,*) 'MISSING ', idbod(ibod)
644          ibod=ibod+1
645      else
646          write (*,*) 'Not an option. Redo'
647      endif
648      if (ibod <= nbod) go to 550
649  c
650      ibod=0
651      do 690 k=1,nbod
652  c
653  c Process measured body coordinates
654  c
655          ibod=ibod+1
656      590      if (ibod>nbod) go to 700
657          if (xy(1,ibod)<=0) then
658              ibod=ibod+1
659              go to 590
660          endif
661          kk=ibod
662          x=xy(1,ibod)
663          y=xy(2,ibod)
664          idpt=idbod(ibod)
665  c
666  c Correct Measured Coordinates for Film Shrinkage
667  c
668          xt=(x*del(1)+y*del(2)+del(3))/(x*del(4)+y*del(5)+1.0)
669          yt=(x*del(6)+y*del(7)+del(8))/(x*del(4)+y*del(5)+1.0)
670  c
671          write (out,2605) idpt,x,y,xt,yt
672  c
673  c Write Records for Triangulation Input to file: "img.dat"
674          write (img,1610) idpt,xt,yt,ifram(ians)
675      690      continue
676  c
677      700      icount=0
678      710      write (*,*)' Re-do first fiducial'
679          read (dig) data
680          write (*,*) char(7)
681  c
682  c DECODE data from CHARACTER to INTEGER

```

Anthropometry and Initial Conditions Photogrammetric Program

```

683 c
684     if (ichar ( data(1:1) ) < 32) data(1:16) = data(2:17)
685     read (data, 20) ibutt,ix,iy
686     if(iabs(ix-isavex)+iabs(iy-isavey) > 3*(rmsx+rmsy)/units)then

```

F77L - Lahey FORTRAN 77, Version 5.00 19 Mar 92 14:56:42

Page 15

SUBROUTINE BODY Compiling Options:

/NO/N2/N3/N7/NA/A1/NA2/NB/NC/C1/ND/NE/NF/H/I/NK/NL/P/NQ1/R/S/NT/NV/W/NX/NZ1

Source file Listing

```

687     write (*,*) ' You blew it', ix, iy, ' vs.', isavex, isavey
688     write (*,*) char(7)
689     write (*,*) char(7)
690     icount=icount+1
691     if(icount<=4) go to 710
692     write(*,*) 'No more tries...origin lost...going back to menu'
693     write (img,'(a8)') '*****'
694     go to 1
695 endif
696 pause
697 write (img,'(a8)') '*****'
698 go to 1
699 c
700 999 call CLEAR
701 write (out,*)char(12)
702 c
703 1370 format (2i1,8x,3f10.3)
704 1410 format (2x,i4,4x,2f10.4)
705 1440 format (2d20.10)
706 1445 format (3d20.10)
707 1450 format (///42x,sp,'CALIBRATED FOCAL LENGTH = ',f9.3,' mm.')
708 1460 format (///51x,sp,'LENS DISTORTION'///51x,'RADIAL PARAMETERS'/31x
709 .          'K0='d15.8d2,' K1='d15.8d2,' K2='d15.8d2/51x'K3='d15.8d2
710 .          ,//:45x,'LENS DECENTRATION PARAMETERS'/31x,'J1= 'd15.8d2,
711 .          ' J2= 'd15.8d2,' PHI= 'd15.8d2/)
712 c
713 1470 format (i2)
714 1480 format (2f10.3)
715 1485 format (8x,'Calibrated Focal Length (CFL) in millimeters = ')
716 1500 format (44x,2f13.3)
717 1510 format (6x,i4,6f10.3)
718 1516 format (a8,2x,sp,f10.3:,ss,2(f10.3),10x)
719 1580 format (2x,a8,6f10.3)
720 1605 format (34x,a8,2x,2f10.3,1x,2f10.3)
721 1610 format (a8,2x,2f10.4,15x,'Photo ',a8)
722 c
723 2380 format (20x,'Fiducial Measurements of Frame ',a8// 24x,'ID',12x,
724 .          'Measured'/37x,'X',14x,'Y')
725 2400 format (16x,'Calibrated Fiducial Coordinates of Frame ',a8//
726 .          26x,'Fid', 9x, 'X', 12x, 'Y')
727 2420 format (25x,i4,5x,f8.3,5x,f8.3)
728 2450 format (//25x,sp,'Calibrated Focal Length = ',f9.3,' mm.')
729 2460 format (///31x,sp,'Lens Distortion'///31x,'Radial Parameters'/11x
730 .          'K0='d15.8d2,' K1='d15.8d2,' K2='d15.8d2/31x'K3='d15.8d2
731 .          ,//:25x,'Lens Decentration Parameters'/11x,'J1= 'd15.8d2,
732 .          ' J2= 'd15.8d2,' PHI= 'd15.8d2/)
733 2500 format (24x,2f13.3)
734 2550 format (///i18,'-Parameter Residuals of the Fiducial Coordinates'//
735 .          23x,'Fid', 11x, 'X', 14x, 'Y')
736 2560 format (22x,i4,2f15.3)
737 2570 format (//22x,'Plate Coordinates for Frame ',a8// ID',11x,
738 .          'Measured',13x,'Adjusted',13x,'Max Spread',11x,'Frame'/
739 .          17x,'X',9x,'Y',10x,'X',9x,'Y',10x,'X',9x,'Y')

```

NAVAL BIODYNAMICS LABORATORY SOFTWARE DOCUMENTATION

F77L - Lahey FORTRAN 77, Version 5.00 19 Mar 92 14:56:42
 SUBROUTINE BODY Compiling Options:
 /N0/N2/N3/N7/NA/A1/NA2/NB/NC/C1/ND/NE/NF/H/I/NK/NL/P/NQ1/R/S/NT/NV/W/NX/NZ1
 Source file Listing

Page 16

```

740 2575 format (//22x,'Plate Coordinates for Frame ',a8//18x,'ID',11x,
741 .          'Measured',13x,'Adjusted'/30x,'X',9x,'Y',10x,'X',9x,'Y')
742 2600 format (x,a8,2x,2f10.3,1x,2f10.3,1x,2f10.3)
743 2605 format (14x,a8,2x,2f10.3,1x,2f10.3)
744      end
  
```

F77L - Lahey FORTRAN 77, Version 5.00 19 Mar 92 14:56:42
 SUBROUTINE FID Compiling Options:
 /N0/N2/N3/N7/NA/A1/NA2/NB/NC/C1/ND/NE/NF/H/I/NK/NL/P/NQ1/R/S/NT/NV/W/NX/NZ1
 Source file Listing

Page 17

```

745 c-----
746      SUBROUTINE FID(Z)
747 c Intersects the edge lines (formed by a least squares on 3 points)
748 c to give the corner fiducials. Stores output back in the input array.
749      implicit real*8 (a-d, x-z)
750      real*8 z(2,12), x(3), y(3)
751      n=3
752 c left
753      x1=0.
754      y1=0.
755      y2=0.
756      xy=0.
757      do i=1, 3
758          x(i)=z(1,9+i)      ! 10, 11, 12
759          y(i)=z(2,9+i)
760          x1=x1+x(i)
761          y1=y1+y(i)
762          y2=y2+y(i)*y(i)
763          xy=xy+x(i)*y(i)
764      enddo
765      den=n*y2-y1*y1
766      c= ( n*xy-y1*x1)/den
767      d=-(y1*xy-x1*y2)/den
768 c top
769      x1=0.
770      y1=0.
771      x2=0.
772      xy=0.
773      do i=1, 3
774          x(i)=z(1,i)        ! 1, 2, 3
775          y(i)=z(2,i)
776          x1=x1+x(i)
777          y1=y1+y(i)
778          x2=x2+x(i)*x(i)
779          xy=xy+x(i)*y(i)
780      enddo
781      den=n*x2-x1*x1
782      a= ( n*xy-y1*x1)/den
783      b=-(x1*xy-y1*x2)/den
784 c
785      z(1,3)=(b*c+d)/(1-a*c)      ! upper left = 3rd
786      z(2,3)=(a*d+b)/(1-a*c)
787 c
788      cx=c
789      dx=d
790 c right
791      x1=0.
  
```


Anthropometry and Initial Conditions Photogrammetric Program

```

792      y1=0.
793      y2=0.
794      xy=0.
795      do i=1, 3
796          x(i)=z(1,3+i)      ! 4, 5, 6

```

F77L - Lahey FORTRAN 77, Version 5.00 19 Mar 92 14:56:42

Page 18

SUBROUTINE FID Compiling Options:

/NO/N2/N3/N7/NA/A1/NA2/NB/NC/C1/ND/NE/NF/H/I/NK/NL/P/NQ1/R/S/NT/NV/W/NX/NZ1

Source file Listing

```

797      y(i)=z(2,3+i)
798      x1=x1+x(i)
799      y1=y1+y(i)
800      y2=y2+y(i)*y(i)
801      xy=xy+x(i)*y(i)
802      enddo
803      den=n*y2-y1*y1
804      c= ( n*xy-y1*x1)/den
805      d=-(y1*xy-x1*y2)/den
806      c
807      z(1,2)=(b*c+d)/(1-a*c)      ! upper right = 2nd
808      z(2,2)=(a*d+b)/(1-a*c)
809      c bottom
810      x1=0.
811      y1=0.
812      x2=0.
813      xy=0.
814      do i=1, 3
815          x(i)=z(1,6+i)      ! 7, 8, 9
816          y(i)=z(2,6+i)
817          x1=x1+x(i)
818          y1=y1+y(i)
819          x2=x2+x(i)*x(i)
820          xy=xy+x(i)*y(i)
821      enddo
822      den=n*x2-x1*x1
823      a= ( n*xy-y1*x1)/den
824      b=-(x1*xy-y1*x2)/den
825      c
826      z(1,1)=(b*c+d)/(1-a*c)      ! lower right = 1st
827      z(2,1)=(a*d+b)/(1-a*c)
828      c
829      z(1,4)=(b*c+dx)/(1-a*c*x)      ! lower left = 4th
830      z(2,4)=(a*d+b)/(1-a*c*x)
831      end

```

F77L - Lahey FORTRAN 77, Version 5.00 19 Mar 92 14:56:42

Page 19

SUBROUTINE FOURP Compiling Options:

/NO/N2/N3/N7/NA/A1/NA2/NB/NC/C1/ND/NE/NF/H/I/NK/NL/P/NQ1/R/S/NT/NV/W/NX/NZ1

Source file Listing

```

832      c-----
833      SUBROUTINE FOURP
834      c
835      c Calculate the 3 or 4 Parameter Transformation Between an Exact Set
836      c of Data and a Corresponding Set of Measured Data.
837      c
838      implicit real*8 (a-h,o-z)
839      intrinsic dsqrt
840      dimension am(2,4), cm(2)
841      common calcor(2,50),obscor(2,50),eqn(8,9),del(8),ich3, nfid

```

NAVAL BIODYNAMICS LABORATORY SOFTWARE DOCUMENTATION

```

842 c
843     do i=1,4
844         do j=1,5
845             eqn(i,j)=0.0d0
846         enddo
847     enddo
848     am(1,3)=1.0d0
849     am(1,4)=0.0d0
850     am(2,3)=0.0d0
851     am(2,4)=1.0d0
852     do i=1,nfid
853         am(1,1)=obscor(1,i)
854         am(1,2)=obscor(2,i)
855         am(2,1)=am(1,2)
856         am(2,2)=-am(1,1)
857         cm(1)=calcor(1,i)
858         cm(2)=calcor(2,i)
859         do j=1,4
860             do k=1,2
861                 eqn(j,5)=eqn(j,5)+am(k,j)*cm(k)
862             do l=1,4
863                 eqn(j,l)=eqn(j,l)+am(k,j)*am(k,l)
864             enddo
865         enddo
866     enddo
867     enddo
868     call LINSOL(4)
869     if (ich3==0) go to 1060
870 c
871 c If ich3<>0 Transform the 4-param to a 3-param
872 c
873     scale=eqn(1,5)**2+eqn(2,5)**2
874     scale=dsqrt(scale)
875     eqn(1,5)=eqn(1,5)/scale
876     eqn(2,5)=eqn(2,5)/scale
877     sum1=0.0d0
878     sum2=0.0d0
879     do i=1,nfid
880         x=obscor(1,i)
881         y=obscor(2,i)
882         sum1=sum1+calcor(1,i)-eqn(1,5)*x-eqn(2,5)*y
883         sum2=sum2+calcor(2,i)+eqn(2,5)*x-eqn(1,5)*y

```

F77L - Lahey FORTRAN 77, Version 5.00 19 Mar 92 14:56:42
 SUBROUTINE FOURP Compiling Options:
 /NO/N2/N3/N7/NA/A1/NA2/NB/NC/C1/ND/NE/NF/H/I/NK/NL/P/NQ1/R/S/NT/NV/W/NX/NZ1
 Source file Listing

Page 20

```

884     enddo
885     eqn(3,5)=sum1/nfid
886     eqn(4,5)=sum2/nfid
887 c
888 c Form Transformation parameters vector
889 c
890 1060 del(1)=eqn(1,5)
891     del(2)=eqn(2,5)
892     del(3)=eqn(3,5)
893     del(4)=0.0d0
894     del(5)=0.0d0
895     del(6)=-del(2)
896     del(7)=del(1)
897     del(8)=eqn(4,5)
898     end

```

Anthropometry and Initial Conditions Photogrammetric Program

F77L - Lahey FORTRAN 77, Version 5.00 19 Mar 92 14:56:42

Page 21

SUBROUTINE FIVEP Compiling Options:

/NO/N2/N3/N7/NA/A1/NA2/NB/NC/C1/ND/NE/NF/H/I/NK/NL/P/NQ1/R/S/NT/NV/W/NX/NZ1

Source file Listing

```
899 c-----
900 SUBROUTINE FIVEP
901 c
902 c Calculate the FIVE Parameter Transformation Between an Exact Set
903 c of Data and a Corresponding Set of Measured Data.
904 c
905 implicit real*8 (a-h,o-z)
906 intrinsic dsin, dcos, dabs
907 dimension b(2,5),c(2),cv(5),par(5)
908 common calcor(2,50),obscor(2,50),eqn(8,9),del(8),ich3, nfid
909 c
910 par(1)=dsqrt(del(1)**2+del(2)**2)
911 par(2)=par(1)
912 par(3)=atan2(del(2),del(1))
913 par(4)=del(3)
914 par(5)=del(8)
915 b(1,2)=0.0d0
916 b(1,5)=0.0d0
917 b(2,1)=0.0d0
918 b(2,4)=0.0d0
919 do 30 ii=1,10
920 do i=1, 5
921 cv(i)=0.0d0
922 do j=1, 5
923 eqn(i, j)=0.0d0
924 enddo
925 enddo
926 do i=1,nfid
927 b(1,4)=par(1)
928 b(2,5)=par(2)
929 sint=dsin(par(3))
930 cost=dcos(par(3))
931 x=obscor(1,i)
932 y=obscor(2,i)
933 c1=-x*sint+y*cost
934 c2= x*cost+y*sint
935 b(1,1)=c2*par(1)
936 b(1,3)=c1*par(1)**2
937 b(2,2)=c1*par(2)
938 b(2,3)=-c2*par(2)**2
939 c(1)=par(1)*(calcor(1,i)-par(1)*c2-par(4))
940 c(2)=par(2)*(calcor(2,i)-par(2)*c1-par(5))
941 do j=1,5
942 do k=1,2
943 cv(j)=cv(j)+b(k,j)*c(k)
944 do l=1,5
945 eqn(j,l)=eqn(j,l)+b(k,j)*b(k,l)
946 enddo
947 enddo
948 enddo
949 enddo
950 c
951 c Solve normal equations
```

NAVAL BIODYNAMICS LABORATORY SOFTWARE DOCUMENTATION

F77L - Lahey FORTRAN 77, Version 5.00 19 Mar 92 14:56:42

Page 22

SUBROUTINE FIVEP Compiling Options:
/NO/N2/N3/N7/NA/A1/NA2/NB/NC/C1/ND/NE/NF/H/I/NK/NL/P/NQ1/R/S/NT/NV/W/NX/NZ1
Source file Listing

```

952 c
953     call LINSOL(5)
954     do j=1, 5
955         par(j)=par(j)+eqn(j, 6)
956     enddo
957 c
958 c Test for convergence
959 c
960     do 20 j=1, 5
961         c1=dabs(eqn(j, 6))
962         epsln=1.0d-6
963         if(j>3)epsln=1.0d-4
964         if(c1>epsln)go to 30
965     20 continue
966         go to 40
967     30 continue
968     call CLEAR
969     write (*,*) char(7)
970     write (*,*)' Error in FIVEP'
971     stop
972 c
973 c Form transformation parameters vector
974 c
975     40 sint=dsin(par(3))
976     cost=dcos(par(3))
977     del(1)=par(1)*cost
978     del(2)=par(1)*sint
979     del(3)=par(4)
980     del(4)=0.0d0
981     del(5)=0.0d0
982     del(6)=-par(2)*sint
983     del(7)=par(2)*cost
984     del(8)=par(5)
985     end

```

F77L - Lahey FORTRAN 77, Version 5.00 19 Mar 92 14:56:42

Page 23

SUBROUTINE SIXP Compiling Options:
/NO/N2/N3/N7/NA/A1/NA2/NB/NC/C1/ND/NE/NF/H/I/NK/NL/P/NQ1/R/S/NT/NV/W/NX/NZ1
Source file Listing

```

986 c-----
987     SUBROUTINE SIXP
988 c
989 c Calculate the SIX Parameter Transformation Between an Exact Set
990 c of Data and a Corresponding Set of Measured Data.
991 c
992     implicit real*8 (a-h,o-z)
993     dimension ans(2,3), ccc(3,3), ddd(3,2), rrr(2,2), err(2)
994     common calcor(2,50),obscor(2,50),eqn(8,9),del(8),ich3, nfid
995 c
996 c Zero Normal Equation Area.
997 c
998     do i=1,2
999         do j=1,3
1000             ccc(i,j)=0.0d0
1001             ddd(j,i)=0.0d0
1002         enddo
1003     enddo

```

Anthropometry and Initial Conditions Photogrammetric Program

```
1004 c
1005 c   Compute Normal Equations
1006 c
1007     do i=1,nfid
1008       do j=1,2
1009         ccc(j,3)=ccc(j,3)+calcor(j,i)
1010         ddd(3,j)=ddd(3,j)+obscor(j,i)
1011       do k=1,2
1012         ccc(j,k)=ccc(j,k)+calcor(j,i)*calcor(k,i)
1013         ddd(j,k)=ddd(j,k)+calcor(j,i)*obscor(k,i)
1014       enddo
1015     enddo
1016   enddo
1017   ccc(3,1)=ccc(1,3)
1018   ccc(3,2)=ccc(2,3)
1019   ccc(3,3)=nfid
1020 c
1021 c   Compute Inverse of Normal Matrix.
1022 c
1023   iggy=3
1024   call INVERT (CCC,IGGY,DET)
1025 c
1026 c   Compute the Transformation Parameters
1027 c
1028     do i=1,2
1029       do j=1,3
1030         ans(i,j)=0.0d0
1031       do k=1,3
1032         ans(i,j)=ans(i,j)+ccc(j,k)*ddd(k,i)
1033       enddo
1034     enddo
1035   enddo
1036 c
1037 c   Calculate the Transformation from Measured Data to Exact Data.
1038 c
```

F77L - Lahey FORTRAN 77, Version 5.00 19 Mar 92 14:56:42

Page 24

SUBROUTINE SIXP Compiling Options:
/NO/N2/N3/N7/NA/A1/NA2/NB/NC/C1/ND/NE/NF/H/I/NK/NL/P/NQ1/R/S/NT/NV/W/NX/NZ1
Source file Listing

```
1039     do i=1,2
1040       do j=1,2
1041         rrr(i,j)=ans(i,j)
1042       enddo
1043     enddo
1044     iggy=2
1045     call INVERT (RRR,IGGY,DET)
1046     do i=1,2
1047       do j=1,2
1048         ans(i,j)=rrr(i,j)
1049       enddo
1050     enddo
1051     do i=1,2
1052       err(i)=-ans(i,1)*ans(1,3)-ans(i,2)*ans(2,3)
1053     enddo
1054     do i=1,2
1055       ans(i,3)=err(i)
1056     enddo
1057 c
1058 c   Form transformation parameters vector
1059 c
1060     del(1)=ans(1,1)
1061     del(2)=ans(1,2)
```

NAVAL BIODYNAMICS LABORATORY SOFTWARE DOCUMENTATION

```

1062      del(3)=ans(1,3)
1063      del(4)=0.0d0
1064      del(5)=0.0d0
1065      del(6)=ans(2,1)
1066      del(7)=ans(2,2)
1067      del(8)=ans(2,3)
1068      end

```

F77L - Lahey FORTRAN 77, Version 5.00 19 Mar 92 14:56:42

Page 25

SUBROUTINE EIGHTP Compiling Options:

/NO/N2/N3/N7/NA/A1/NA2/NB/NC/C1/ND/NE/NF/H/I/NK/NL/P/NQ1/R/S/NT/NV/W/NX/NZ1

Source file Listing

```

1069 c-----
1070      SUBROUTINE EIGHTP
1071 c
1072 c Calculate the EIGHT Parameter Transformation Between an Exact Set
1073 c of Data and a Corresponding Set of Measured Data.
1074 c
1075      implicit real*8 (a-h,o-z)
1076      common calcor(2,50),obscor(2,50),eqn(8,9),del(8),ich3, nfid
1077      real*8      tem(8)
1078 c
1079 c Zero the matrix of linear equations EQN
1080 c
1081      do i=1,8
1082          del(i)=0.0d0
1083          do j=1,9
1084              eqn(i,j)=0.0d0
1085          enddo
1086      enddo
1087 c
1088 c Compute approximate values for the transformation parameters
1089 c
1090      do i=1,nfid
1091          call ACCAPR (calcor(1,i),calcor(2,i),obscor(1,i),obscor(2,i))
1092      enddo
1093      n=8
1094      call INVERT (eqn, n, d)
1095      do i=1, 8
1096          do j=1, 8
1097              del(i)=del(i)+eqn(i, j)*eqn(j, 9)
1098          enddo
1099      enddo
1100 c
1101 c Compute the transformation parameters by least squares
1102 c
1103      do 50 m=1,5
1104 c
1105 c Zero the normal equations
1106 c
1107          do i=1,8
1108              tem(i)=0.0d0
1109              do j=1,9
1110                  eqn(i,j)=0.0d0
1111              enddo
1112          enddo
1113 c
1114 c Form the normal equations
1115 c
1116          do i=1,nfid
1117              call ACCNEQ(calcor(1,i),calcor(2,i),obscor(1,i),obscor(2,i))
1118          enddo
1119 c

```

Anthropometry and Initial Conditions Photogrammetric Program

1120 c Solve the normal equations
1121 c

F77L - Lahey FORTRAN 77, Version 5.00 19 Mar 92 14:56:42

Page 26

SUBROUTINE EIGHTP Compiling Options:
/NO/N2/N3/N7/NA/A1/NA2/NB/NC/C1/ND/NE/NF/H/I/NK/NL/P/NQ1/R/S/NT/NV/W/NX/NZ1
Source file Listing

```
1122      call INVERT(eqn, n, d)
1123      do i=1, 8
1124        do j=1, 8
1125          tem(i)=tem(i)+eqn(i, j)*eqn(j, 9)
1126        enddo
1127      enddo
1128 c
1129 c Correct the approximate values of the transformation parameters
1130 c
1131      do i=1, 8
1132        del(i)=del(i)+tem(i)
1133      enddo
1134 c
1135 c Test the solution for convergence
1136 c
1137      do i=1,8
1138        d=dabs(del(i))/(del(i)-tem(i))-1.0)
1139        if (d>.001d0) go to 50
1140      enddo
1141      return
1142 50    continue
1143      end
```

F77L - Lahey FORTRAN 77, Version 5.00 19 Mar 92 14:56:42

Page 27

SUBROUTINE LINSOL Compiling Options:
/NO/N2/N3/N7/NA/A1/NA2/NB/NC/C1/ND/NE/NF/H/I/NK/NL/P/NQ1/R/S/NT/NV/W/NX/NZ1
Source file Listing

```
1144 c-----
1145      SUBROUTINE LINSOL(NPAR)
1146 c
1147 c Solution of (NPAR) linear equations in (NPAR) unknowns.
1148 c
1149      implicit real*8 (a-h,o-z)
1150      common calcor(2,50),obscor(2,50),eqn(8,9),del(8),ich3, nfid
1151 c
1152      do 1040 k=1,npar
1153        m=npar+1
1154        do j=k,npar+1
1155          eqn(k,m)=eqn(k,m)/eqn(k,k)
1156        m=m-1
1157      enddo
1158      do 1030 i=1,npar
1159        if (i==k) go to 1030
1160        m=npar+1
1161        do l=k,npar+1
1162          eqn(i,m)=eqn(i,m)-eqn(i,k)*eqn(k,m)
1163        m=m-1
1164      enddo
1165 1030    continue
1166 1040    continue
1167 c
1168      end
```

NAVAL BIODYNAMICS LABORATORY SOFTWARE DOCUMENTATION

F77L - Lahey FORTRAN 77, Version 5.00 19 Mar 92 14:56:42

Page 28

SUBROUTINE ACCAPR Compiling Options:

/NO/N2/N3/N7/NA/A1/NA2/NB/NC/C1/ND/NE/NF/H/I/NK/NL/P/NQ1/R/S/NT/NV/W/NX/NZ1

Source file Listing

```

1169 c-----
1170       SUBROUTINE ACCAPR (XG,YG,XP,YP)
1171 c
1172 c Evaluate the contribution of one point to the 8 by 9 matrix of
1173 c normal equations for computation of approximate values of the
1174 c eight-parameter film shrinkage transformation.
1175 c
1176 c       XG: Calibrated X Fiducial coordinate
1177 c       YG: Calibrated Y Fiducial coordinate
1178 c       XP: Observed X Fiducial coordinate
1179 c       YP: Observed Y Fiducial coordinate
1180 c       EQN: 8 X 8 Coefficient matrix of the Normal Equation
1181 c           with the vector of constants in column 9.
1182 c
1183       implicit real*8 (a-h,o-z)
1184       dimension am(2,8), bm(2)
1185       common calcor(2,50),obscor(2,50),eqn(8,9),del(8),ich3, nfid
1186 c
1187       am(1,1)=xp
1188       am(1,2)=yp
1189       am(1,3)=1.0d0
1190       am(1,4)=-xg*xp
1191       am(1,5)=-xg*yp
1192       am(1,6)=0.0d0
1193       am(1,7)=0.0d0
1194       am(1,8)=0.0d0
1195       am(2,1)=0.0d0
1196       am(2,2)=0.0d0
1197       am(2,3)=0.0d0
1198       am(2,4)=-xp*yg
1199       am(2,5)=-yp*yg
1200       am(2,6)=xp
1201       am(2,7)=yp
1202       am(2,8)=1.0d0
1203       bm(1)=xg
1204       bm(2)=yg
1205       do i=1,8
1206         do j=1,8
1207           do k=1,2
1208             eqn(i,j)=eqn(i,j)+am(k,i)*am(k,j)
1209           enddo
1210         enddo
1211       enddo
1212       do i=1,8
1213         do j=1,2
1214           eqn(i,9)=eqn(i,9)+am(j,i)*bm(j)
1215         enddo
1216       enddo
1217       end

```

F77L - Lahey FORTRAN 77, Version 5.00 19 Mar 92 14:56:42

Page 29

SUBROUTINE ACCNEQ Compiling Options:

/NO/N2/N3/N7/NA/A1/NA2/NB/NC/C1/ND/NE/NF/H/I/NK/NL/P/NQ1/R/S/NT/NV/W/NX/NZ1

Source file Listing

```

1218 c-----
1219       SUBROUTINE ACCNEQ (XG,YG,XP,YP)
1220 c

```


Anthropometry and Initial Conditions Photogrammetric Program

```

1221 c Evaluate the contribution of one point to the normal equation
1222 c required for Subroutine EIGHT. The normal equations are
1223 c required to compute corrections to the last estimate of the
1224 c eight transformation parameters. This is called once for each
1225 c point.
1226 c
1227 c      XG: Calibrated X Fiducial coordinate
1228 c      YG: Calibrated Y Fiducial coordinate
1229 c      XP: Observed X Fiducial coordinate
1230 c      YP: Observed Y Fiducial coordinate
1231 c      EQN: 8 X 8 Coefficient matrix of the Normal Equation
1232 c           with the vector of constants in column 9.
1233 c
1234 c
1235 c      implicit real*8 (a-h,o-z)
1236 c      dimension am(2,2), bm(2,8), cm(2), amm(2,2)
1237 c      common calcor(2,50),obscor(2,50),eqn(8,9),del(8),ich3, nfid
1238 c
1239 c      am(1,1)=del(1)-xg*del(4)
1240 c      am(1,2)=del(2)-xg*del(5)
1241 c      am(2,1)=del(6)-yg*del(4)
1242 c      am(2,2)=del(7)-yg*del(5)
1243 c      bm(1,1)=xp
1244 c      bm(1,2)=yp
1245 c      bm(1,3)=1.0d0
1246 c      bm(1,4)=-xp*xg
1247 c      bm(1,5)=-yp*xg
1248 c      bm(1,6)=0.0d0
1249 c      bm(1,7)=0.0d0
1250 c      bm(1,8)=0.0d0
1251 c      bm(2,1)=0.0d0
1252 c      bm(2,2)=0.0d0
1253 c      bm(2,3)=0.0d0
1254 c      bm(2,4)=-xp*yg
1255 c      bm(2,5)=-yp*yg
1256 c      bm(2,6)=xp
1257 c      bm(2,7)=yp
1258 c      bm(2,8)=1.0d0
1259 c      cm(1)=xp*am(1,1)+yp*am(1,2)+del(3)-xg
1260 c      cm(2)=xp*am(2,1)+yp*am(2,2)+del(8)-yg
1261 c
1262 c Form modified covariance matrix AMM
1263 c
1264 c      do i=1,2
1265 c        do j=1,2
1266 c          amm(i,j)=0.0d0
1267 c          do k=1,2
1268 c            amm(i,j)=amm(i,j)+am(i,k)*am(j,k)
1269 c          enddo

```

F77L - Lahey FORTRAN 77, Version 5.00 19 Mar 92 14:56:42
 SUBROUTINE ACCNEQ Compiling Options:
 /N0/N2/N3/N7/NA/A1/NA2/NB/NC/C1/ND/NE/NF/H/I/NK/NL/P/NQ1/R/S/NT/NV/W/NX/NZ1
 Source file Listing

Page 30

```

1270 c      enddo
1271 c      enddo
1272 c      d=amm(1,1)*amm(2,2)-amm(1,2)*amm(2,1)
1273 c      am(1,1)= amm(2,2)/d
1274 c      am(2,2)= amm(1,1)/d
1275 c      am(1,2)=-amm(2,1)/d
1276 c      am(2,1)= amm(1,2)
1277 c
1278 c Form normal equations

```

NAVAL BIODYNAMICS LABORATORY SOFTWARE DOCUMENTATION

```

1279 c
1280     do i=1,8
1281         do j=1,8
1282             do k=1,2
1283                 do l=1,2
1284                     eqn(i,j)=eqn(i,j)+bm(k,i)*am(k,l)*bm(l,j)
1285                 enddo
1286             enddo
1287         enddo
1288     enddo
1289     do i=1,8
1290         do k=1,2
1291             do l=1,2
1292                 eqn(i,9)=eqn(i,9)-bm(k,i)*am(k,l)*cm(l)
1293             enddo
1294         enddo
1295     enddo
1296 end

```

F77L - Lahey FORTRAN 77, Version 5.00 19 Mar 92 14:56:42

Page 31

SUBROUTINE INVERT Compiling Options:

/NO/N2/N3/N7/NA/A1/NA2/NB/NC/C1/ND/NE/NF/H/I/NK/NL/P/NQ1/R/S/NT/NV/W/NX/NZ1
Source file Listing

```

1297 c-----
1298     SUBROUTINE INVERT (A,N,D)
1299 c
1300 c Find the Inverse of a Matrix by the Gaussian Elimination Method.
1301 c A: Array in which the matrix to be inverted is located.
1302 c The routine will search for the largest non-singular matrix in
1303 c the array A and invert it & return it in the same locations of A.
1304 c N: The first dimension of A. It must be a variable in the call list.
1305 c The rank of largest matrix contained in A will be returned in N.
1306 c D: The determinant of the largest non-singular matrix in A.
1307 c L & M: Vectors of dimension N used temporarily.
1308 c
1309 c
1310     implicit real*8 (a-h,o-z)
1311     dimension a(64), l(8), m(8)
1312 c
1313 c Initiate the continued product of pivots becoming the determinant.
1314 c
1315     d=1.0d0
1316 c
1317 c Initiate the counter which contains the rank of the matrix.
1318 c
1319     ksave=0
1320 c
1321 c Start the main elimination loop.
1322 c
1323     do 1090 k=1,n
1324 c
1325 c Search for the largest element
1326 c
1327         l(k)=k
1328         m(k)=k
1329         kk=k+n*(k-1)
1330         biga=a(kk)
1331         do 1010 i=k,n
1332             do 1010 j=k,n
1333                 ij=i+n*(j-1)
1334                 if (dabs(biga)>=dabs(a(ij))) go to 1010
1335                 biga=a(ij)
1336                 l(k)=i

```

Anthropometry and Initial Conditions Photogrammetric Program

```
1337          m(k)=j
1338 1010      continue
1339 c
1340 c Largest element of zero means the largest matrix in A is less than N.
1341 c
1342          if (biga==0) GO TO 1100
1343 c
1344 c Interchange rows
1345 c
1346          j=l(k)
1347          ksave=k
1348          if (l(k)<=k) go to 1030
```

F77L - Lahey FORTRAN 77, Version 5.00 19 Mar 92 14:56:42

Page 32

SUBROUTINE INVERT Compiling Options:
/NO/N2/N3/N7/NA/A1/NA2/NB/NC/C1/ND/NE/NF/H/1/NK/NL/P/NQ1/R/S/NT/NV/W/NX/NZ1
Source file Listing

```
1349          do i=1,n
1350              ki=k+n*(i-1)
1351              ji=j+n*(i-1)
1352              tem=-a(ki)
1353              a(ki)=a(ji)
1354              a(ji)=tem
1355          enddo
1356 c
1357 c Interchange columns.
1358 c
1359 1030          i=m(k)
1360          if (m(k)<=k) go to 1050
1361          do j=1,n
1362              jk=j+n*(k-1)
1363              ji=j+n*(i-1)
1364              tem=-a(jk)
1365              a(jk)=a(ji)
1366              a(ji)=tem
1367          enddo
1368 c
1369 c Divide column by minus pivot
1370 c
1371 1050          do 1060 i=1,n
1372              if (i==k) go to 1060
1373              ik=i+n*(k-1)
1374              a(ik)=a(ik)/(-a(kk))
1375 1060          continue
1376 c
1377 c Reduce matrix
1378 c
1379          do 1070 i=1,n
1380              do 1070 j=1,n
1381                  if (i==k.or.j==k) go to 1070
1382                  ij=i+n*(j-1)
1383                  ik=i+n*(k-1)
1384                  kj=k+n*(j-1)
1385                  a(ij)=a(ik)*a(kj)+a(ij)
1386 1070          continue
1387 c
1388 c Divide row by pivot
1389 c
1390          do 1080 j=1,n
1391              if (j==k) go to 1080
1392              kj=k+n*(j-1)
1393              a(kj)=a(kj)/a(kk)
1394 1080          continue
```

NAVAL BIODYNAMICS LABORATORY SOFTWARE DOCUMENTATION

```

1395 c
1396 c Continued product of pivots
1397 c
1398         d=d*a(kk)
1399         a(kk)=1.0d0/a(kk)
1400 1090 continue

```

F77L - Lahey FORTRAN 77, Version 5.00 19 Mar 92 14:56:42

Page 33

SUBROUTINE INVERT Compiling Options:

/NO/N2/N3/N7/NA/A1/NA2/NB/NC/C1/ND/NE/NF/H/I/NK/NL/P/NQ1/R/S/NT/NV/W/NX/NZ1
Source file Listing

```

1401 c
1402 c Final row and column interchange
1403 c
1404 1100 k=ksave+1
1405 1110 k=k-1
1406     if (k<=0) go to 1150
1407 c
1408 c Restore columns.
1409 c
1410     i=l(k)
1411     if (i<=k) go to 1130
1412     do j=1,n
1413         jk=j+n*(k-1)
1414         ji=j+n*(i-1)
1415         tem=a(jk)
1416         a(jk)=-a(ji)
1417         a(ji)=tem
1418     enddo
1419 c
1420 c Restore rows.
1421 c
1422 1130 j=m(k)
1423     if (j<=k) go to 1110
1424     do i=1,n
1425         ki=k+n*(i-1)
1426         ji=j+n*(i-1)
1427         tem=a(ki)
1428         a(ki)=-a(ji)
1429         a(ji)=tem
1430     enddo
1431     go to 1110
1432 c
1433 c Set the rank of the matrix and return to the calling routine.
1434 c
1435 1150 return
1436 end

```

F77L - Lahey FORTRAN 77, Version 5.00 19 Mar 92 14:56:42

Page 34

SUBROUTINE NEWPAG Compiling Options:

/NO/N2/N3/N7/NA/A1/NA2/NB/NC/C1/ND/NE/NF/H/I/NK/NL/P/NQ1/R/S/NT/NV/W/NX/NZ1
Source file Listing

```

1437 c-----
1438     SUBROUTINE NEWPAG
1439 c
1440     common /title/ title, page, out, img, dig
1441     character*74 title
1442     integer page, out, img, dig
1443 c
1444     page=page+1

```

Anthropometry and Initial Conditions Photogrammetric Program

```
1445      if(page>1)write(out,*) char(12)
1446      write (out,10) page,title
1447 10    format(' Naval BioDynamics Laboratory  PREP',31x,'    Page',i3
1448      .      /a74/)
1449      end
```

F77L - Lahey FORTRAN 77, Version 5.00 19 Mar 92 14:56:42

Page 35

SUBROUTINE CLEAR Compiling Options:

/NO/N2/N3/N7/NA/A1/NA2/NB/NC/C1/ND/NE/NF/H/I/NK/NL/P/NQ1/R/S/NT/NV/W/NX/NZ1

Source file Listing

```
1450 c-----
1451      SUBROUTINE CLEAR
1452 c  clears the screen and moves the cursor to row 8.
1453      write (*,*) char(27)//'[2J'
1454      write (*,*) char(27)//'[1;1H'
1455      write (*,*) char(27)//'[8B'
1456      end
```

Customized GIANT Program Listings

Main Program

F77L - Lahey FORTRAN 77, Version 5.01 07 Apr 93 08:59:19

Page 1

PROGRAM NBDL_GIANT Compiling Options:

/NO/N2/N3/N7/NA/A1/NA2/NB/NC/C1/ND/NE/NF/H/I/NK/NL/P/NQ1/R/S/NT/NV/W/NX/NZ1

Source file Listing

```

1      PROGRAM NBDL_GIANT
2      C
3      C  GENERAL INTEGRATED ANALYTICAL TRIANGULATION (GIANT)
4      C
5          common /title/ jtitle, ipage
6          character jtitle*76
7          include 'inc\tapes.inc'
11     1      INTEGER CAMERA,FRAMES,OBJECT
11     2      COMMON /TAPES/ IN,IO,IOS,IOIC, IP1, IP2,
11     3          CAMERA,IMAGES,FRAMES,OBJECT,
11     4          ITAPE1,ITAPE2,ITAPE3,ITAPE4,
11     5          ITAPE5,ITAPE6,ITAPE7,ITAPE0
11     6
8          common /offset/off(2)
9          common /anthr/ians, p(15, 3)
10         real*8 p
11     C
12         character irun*6, fn*12
13         call system('cls')
14         IN=11
15         IO=12
16         IOS=13
17         IP1=14
18         IP2=15
19         CAMERA=IN
20         IMAGES=16
21         FRAMES=IN
22         OBJECT=IN
23         ITAPE1=17
24         ITAPE2=18
25         ITAPE3=19
26         ITAPE4=20
27         ITAPE5=21
28         ITAPE6=22
29         ITAPE7=23
30         ITAPE0=24
31         IOIC=25
32     C
33         write(*,*)' Enter 0 for initial conditions'
34         write(*,*)' Enter 1 for head anthropometry'
35         write(*,*)' Enter 2 for body anthropometry'
36         write(*,*)' Enter 3 for standard giant
37         read(*,*)ians
38         if (ians==0) then
39             open (in, status='old', file='optcams.dat')
40         elseif (ians==1) then
41             open (in, status='old', file='opthead.dat')
42         elseif (ians==2) then
43             open (in, status='old', file='optxray.dat')

```

Anthropometry and Initial Conditions Photogrammetric Program

F77L - Lahey FORTRAN 77, Version 5.01 07 Apr 93 08:59:19

Page 2

PROGRAM NBDL_GIANT Compiling Options:

/NO/N2/N3/N7/NA/A1/NA2/NB/NC/C1/ND/NE/NF/H/I/NK/NL/P/NQ1/R/S/NT/NV/W/NX/NZ1

Source file Listing

```
44     else
45         open (in, status='old', file='opt.dat')
46     endif
47     if(ians==0)then
48 1       write(*,*) ' Enter RUN number (A6): '
49         read (*,*) irun
50         do i=1,6
51             if(irun(i:i)==' ')go to 1
52         enddo
53         write (*,*)
54         jtitle=' 35mm Still Camera System for Initial Conditions of
55         RUN # = '//irun
56         open (images, status='old', file=irun//'im.dat')
57         open (unit=io, status='unknown',file=irun//'.132')
58         open (unit=io, status='unknown',file='nul')
59         open (unit=ios,status='unknown',file=irun//'.out')
60         open (unit=ioic,status='unknown',file=irun//'.ic')
61     elseif(ians<3)then
62         write (*,*) ' Enter HRV number: '
63         read (*,*) ihrv
64         write (*,*)
65         if(ians==1)then
66             write (fn,"(i4.4,'himg.dat')")ihrv
67             jtitle=' 35mm Still Camera System for Head Anthropometry of
68             HRV # = '//fn(1:4)
69             open (unit=ios,status='unknown',file=fn(1:4)//'head.out')
70             open (images,status='old',file =fn)
71             read (images, *) off
72             if (dabs(off(1)+off(2)-10)>2) then
73                 write(*,*) 'Offset sum < 8 or > 12. check it out.'
74                 stop
75             endif
76         else
77             write (fn,"(i4.4,'bimg.dat')")ihrv
78             jtitle=' X-Ray Determination of Body Anthropometry of
79             HRV # = '//fn(1:4)
80             open (unit=ios,status='unknown',file=fn(1:4)//'body.out')
81             open (images,status='old',file =fn)
82         endif
83         open (unit=io, status='unknown',file=fn(1:5)//'.132')
84     else
85         write(*,*) ' Enter title (A76) '
86         write(*,*)
87         read(*,'(A)')jtitle
88         open (images,status='old',file ='img.dat')
89         open (unit=io, status='unknown',file='giant.132')
90         open (unit=ios,status='unknown',file='giant.out')
91     endif
92 C
93     DO 1010 I=ITAPE1,ITAPE6
```

F77L - Lahey FORTRAN 77, Version 5.01 07 Apr 93 08:59:19

Page 3

PROGRAM NBDL_GIANT Compiling Options:

/NO/N2/N3/N7/NA/A1/NA2/NB/NC/C1/ND/NE/NF/H/I/NK/NL/P/NQ1/R/S/NT/NV/W/NX/NZ1

Source file Listing

```
94 1010 OPEN (UNIT=I,STATUS='SCRATCH',FORM='UNFORMATTED')
95 C
96 C Initialize job title, page count, and data set identifications
```

NAVAL BIODYNAMICS LABORATORY SOFTWARE DOCUMENTATION

```

97 C
98 I Page=0
99 CALL CLR
100 write(*,*) char(7)
101 C
102 C Perform data input and structuring phase, then close input files.
103 C
104 CALL CLR
105 CALL PHASE1
106 CLOSE (IN)
107 CLOSE (IMAGES)
108 C
109 C Perform triangulation phase
110 C
111 OPEN (UNIT=ITAPE0,STATUS='UNKNOWN')
112 OPEN (UNIT=ITAPE7,STATUS='SCRATCH',FORM='UNFORMATTED')
113 C
114 CALL CLR
115 WRITE (*,'(37X,'PHASE 2')')
116 CALL PHASE2
117 C
118 C Perform data output phase
119 C
120 CLOSE (ITAPE0)
121 CLOSE (ITAPE1)
122 CALL CLR
123 WRITE (*,'(37X,'PHASE 3')')
124 CALL PHASE3
125 write(*,*) char(7)
126 CALL CLR
127 write(*,*) char(7)
128 if(ians==0)then
129 WRITE (*,"(/////,26X,'Results are in ',a6,'.out.')" )irun
130 WRITE (*,"(/////,16X,'Initial Conditions Results are in ',a6,
131 '.ic.')" )irun
132 elseif(ians==1)then
133 WRITE (*,"(/////,26X,'Results are in ',a4,'head.out.')" )fn(1:4)
134 elseif(ians==2)then
135 WRITE (*,"(/////,26X,'Results are in ',a4,'body.out.')" )fn(1:4)
136 else
137 WRITE (*,"(/////,26X,'Results are in giant.out.')" )
138 endif
139 END

```

Subroutines

F77L - Lahey FORTRAN 77, Version 5.01 07 Apr 93 08:59:19

Page 139

SUBROUTINE STUFFP Compiling Options:

/NO/N2/N3/N7/NA/A1/NA2/NB/NC/C1/ND/NE/NF/H/I/NK/NL/P/NQ1/R/S/NT/NV/W/NX/NZ1

Source file Listing

```

4426 C*****
4427 SUBROUTINE STUFFP(ID2, OBJECT)
4428 C Search object point ids to find matching ids in anthropometry list
4429 C
4430 REAL*8 P, OBJECT(3)
4431 C CHARACTER*4 ID(15)
4432 COMMON /TAPES/ IN,IO,IOS,IDUM(15)
4433 COMMON /ANTHR/ IANTH, P(15, 3)
4434 DIMENSION ID(15)
4435 DATA ID/'r1-l','r2-l','r3-l','r4-l',
4436 'r1-r','r2-r','r3-r','r4-r', 'lon','ron',
4437 'igin','b_Lf', 'b_Rt','eTop', 'eBot' / ! 15
4438 DO I=1, 15

```


Anthropometry and Initial Conditions Photogrammetric Program

```

4439      IF (ID2.EQ.ID(1))THEN
4440 C
4441 C Stuff object points into corresponding locations in array P
4442 C
4443      DO J=1, 3
4444          P(I, J)=OBJECT(J)
4445      enddo
4446      RETURN
4447  ENDIF
4448  enddo
4449  END

```

F77L - Lahey FORTRAN 77, Version 5.01 07 Apr 93 08:59:19

Page 140

SUBROUTINE ANTHRO Compiling Options:

/NO/N2/N3/N7/NA/A1/NA2/NB/NC/C1/ND/NE/NF/H/I/NK/NL/P/NQ1/R/S/NT/NV/W/NX/NZ1

Source file Listing

```

4450 C*****
4451      SUBROUTINE ANTHRO
4452 C Verify that we have the 18/13 needed anthro points,
4453 C call the routine to find the transformations & print results
4454 C
4455      REAL*8 P, X(3), AB(3, 3)
4456      COMMON /TAPES/ IN, IO, IOS, IDUM(15)
4457      COMMON /ANTHR/ IANTH, P(15, 3)
4458      CHARACTER*4 TYPE(2) /'HEAD', 'BODY'/
4459 C
4460      CALL NEWPAG
4461      WRITE(IO, '(44XA40//)') 'ANTHROPOMETRY OUTPUT'
4462      WRITE(IOS, '(20XA40//)') 'ANTHROPOMETRY OUTPUT'
4463      I1=1
4464      I2=10
4465      IF(IANTH.EQ.2)THEN
4466          I1=11
4467          I2=15
4468      ENDIF
4469      DO 10 I=I1, I2
4470          IF(P(I,3).EQ.0.)THEN
4471              WRITE(IO, *) ' Can''t find 10 head or 5 body points--halting'
4472              WRITE(IOS, *) ' Can''t find 10 head or 5 body points--halting'
4473              RETURN
4474          ENDIF
4475 10      CONTINUE
4476 C *****
4477      CALL NBDL (X, AB)
4478      WRITE(IO, 8) TYPE(IANTH), X, TYPE(IANTH), AB
4479      WRITE(IOS, 9) TYPE(IANTH), X, TYPE(IANTH), AB
4480 8      FORMAT(38X'T-PLATE ORIGIN WITH RESPECT TO ', A4,
4481          . ' ANATOMICAL ORIGIN'
4482          . //41X'X= '2PF8.4,'cm Y= 'F8.4,'cm Z= 'F8.4,'cm'OP///
4483          . 35X'T-PLATE ORIENTATION WITH RESPECT TO ', A4,
4484          . ' ANATOMICAL SYSTEM' //3(47X,3F11.6//))
4485 9      FORMAT(14X'T-PLATE ORIGIN WITH RESPECT TO ', A4,
4486          . ' ANATOMICAL ORIGIN'
4487          . //17X'X= '2PF8.4,'cm Y= 'F8.4,'cm Z= 'F8.4,'cm'OP///
4488          . 11X'T-PLATE ORIENTATION WITH RESPECT TO ', A4,
4489          . ' ANATOMICAL SYSTEM' //3(23X,3F11.6//))
4490      END

```

NAVAL BIODYNAMICS LABORATORY SOFTWARE DOCUMENTATION

F77L - Lahey FORTRAN 77, Version 5.01 07 Apr 93 08:59:19

Page 141

SUBROUTINE UVEC Compiling Options:
/NO/N2/N3/N7/NA/A1/NA2/NB/NC/C1/ND/NE/NF/H/I/NK/NL/P/NQ1/R/S/NT/NV/W/NX/NZ1
Source file Listing

```

4491 C*****
4492     SUBROUTINE UVEC (A,K)
4493 C   Make a unit vector: A(K,-) = A(K,-) / MAGNITUDE (A(K, -))
4494 C
4495     IMPLICIT DOUBLE PRECISION (A-H,O-Z)
4496     DIMENSION A(3, 3)
4497 C
4498     B=0
4499     DO 10 I=1, 3
4500 10    B=B+A(K, I)**2
4501     B=DSQRT(B)
4502     DO 20 I=1, 3
4503 20    A(K, I)=A(K, I)/B
4504     END
    
```

F77L - Lahey FORTRAN 77, Version 5.01 07 Apr 93 08:59:19

Page 142

SUBROUTINE NBDL Compiling Options:
/NO/N2/N3/N7/NA/A1/NA2/NB/NC/C1/ND/NE/NF/H/I/NK/NL/P/NQ1/R/S/NT/NV/W/NX/NZ1
Source file Listing

```

4505 C*****
4506     SUBROUTINE NBDL (X, AB)
4507 C   Find the origin & transformation matrix of the T-plate relative to the
4508 C   head (body) anatomical origin in the head (body) anatomical coord system
4509 C
4510     IMPLICIT DOUBLE PRECISION (A-H,O-Z)
4511     COMMON /ANTHR/IANTH, P(15, 3)
4512     DIMENSION X(3), AB(3, 3), A(3, 3), B(3, 3), Q(3)
4513 C
4514     C=0.D0
4515     D=0.D0
4516     IF(IANTH.EQ.1)THEN
4517         call extrapolate ! 1-4-->4 & 5-8-->8
4518         DO 10 I=1, 3
4519 10    C Find origin of Head Anatomical Coordinate System
4520         X(I)=(P(4,I)+P(8,I))/2
4521 C   Find x-axis
4522         A(1,I)=(P(9,I)+P(10,I))/2-X(I)
4523 C   Find origin of T-plate
4524         Q(I)=0
4525 C   Find x-axis of T-plate
4526         B(1,I)=0
4527         if(i==1)B(1,I)=1
4528 C   Find approx. y-axes
4529         A(2,I)=P(4,I)-X(I)
4530         B(2,I)=0
4531         if(i==2)B(2,I)=1
4532 C   Interchange ltp and rtp when processing a-plate (180 rot re z)
4533 C         B(2,I)=P(12,I)-P(11,I) !rhesus right-left xxxxx
4534 C   Find vector from head anat to T-plate
4535 10    Q(I)=Q(I)-X(I)
4536     ELSE
4537         DO 11 I=1, 3
4538 11    C Find origin of Body Anatomical Coordinate System
4539         X(I)=P(11,I)
4540 C   Find x-axis
4541         A(1,I)=X(I)-(P(14,I)+P(15,I))/2
4542 C   Find origin of T-plate
4543         Q(I)=0
    
```

Anthropometry and Initial Conditions Photogrammetric Program

```

4544 C Find x-axis of T-plate
4545         B(1,1)=0
4546         if(i==1)B(1,1)=1
4547 C Find approx. y-axes
4548         A(2,1)=P(12,1)-P(13,1)
4549         B(2,1)=0
4550         if(i==2)B(2,1)=1
4551 C Find vector from body anat to T-plate
4552 11     Q(I)=Q(I)-X(I)
4553         ENDIF

```

F77L - Lahey FORTRAN 77, Version 5.01 07 Apr 93 08:59:19
 SUBROUTINE NBDL Compiling Options:
 /NO/N2/N3/N7/NA/A1/NA2/NB/NC/C1/ND/NE/NF/H/I/NK/NL/P/NQ1/R/S/NT/NV/W/NX/NZ1
 Source file Listing

Page 143

```

4554 C Make unit vectors of x-axes
4555     CALL UVEC(A, 1)
4556     CALL UVEC(B, 1)
4557 C Find components of the approx y-axes along the respective x-axes
4558     DO 20 I=1, 3
4559         C=C+A(1,I)*A(2,I)
4560     20 D=D+B(1,I)*B(2,I)
4561 C Subtract these to yield y-axes perpendicular to the resp x-axes
4562     DO 30 I=1, 3
4563         A(2,I)=A(2,I)-C*A(1,I)
4564     30 B(2,I)=B(2,I)-D*B(1,I)
4565 C Make them of unit length
4566     CALL UVEC(A, 2)
4567     CALL UVEC(B, 2)
4568 C Find the z-axes by taking the cross products of the x-axes & y-axes
4569     DO 40 I=1, 3
4570         J=I+1
4571         IF(J.GT.3)J=J-3
4572         K=I+2
4573         IF(K.GT.3)K=K-3
4574         A(3,I)=A(1,J)*A(2,K)-A(1,K)*A(2,J)
4575     40 B(3,I)=B(1,J)*B(2,K)-B(1,K)*B(2,J)
4576 C Find the components of the transformation vector and matrix in
4577 C the head (body) anatomical coordinate system
4578     DO 50 I=1, 3
4579         X(I)=0.D0
4580     DO 50 J=1, 3
4581         X(I)=X(I)+Q(J)*A(I,J)
4582         AB(J,I)=0.D0
4583     DO 50 K=1, 3
4584     50 AB(J,I)=AB(J,I)+B(I,K)*A(J,K)
4585         END

```

F77L - Lahey FORTRAN 77, Version 5.01 07 Apr 93 08:59:19
 SUBROUTINE EXTRAPOLATE Compiling Options:
 /NO/N2/N3/N7/NA/A1/NA2/NB/NC/C1/ND/NE/NF/H/I/NK/NL/P/NQ1/R/S/NT/NV/W/NX/NZ1
 Source file Listing

Page 144

```

4586 c
4587     SUBROUTINE EXTRAPOLATE
4588     common /offset/off(2)
4589     COMMON /ANTHR/IANTH, P(15, 3)
4590     real*8 p, x(4),y(4),z(4),t(4)
4591     n=4
4592     do k=1, 2
4593         t1=0.d0

```

NAVAL BIODYNAMICS LABORATORY SOFTWARE DOCUMENTATION

```

4594      t2=0.d0
4595      x1=0.d0
4596      xt=0.d0
4597      y1=0.d0
4598      yt=0.d0
4599      z1=0.d0
4600      zt=0.d0
4601      do i=1,n
4602          j=i+4*(k-1)
4603          t(i)=(i-1)*25.4d0      ! 0, 1, 2, 3 in inches
4604          t1=t1+t(i)
4605          t2=t2+t(i)*t(i)
4606          x(i)=p(j,1)
4607          x1=x1+x(i)
4608          xt=xt+t(i)*x(i)
4609          y(i)=p(j,2)
4610          y1=y1+y(i)
4611          yt=yt+t(i)*y(i)
4612          z(i)=p(j,3)
4613          z1=z1+z(i)
4614          zt=zt+t(i)*z(i)
4615      enddo
4616      den=n*t2-t1*t1
4617      ax= ( n*xt-x1*t1)/den
4618      bx=- (t1*xt-x1*t2)/den
4619      ay= ( n*yt-y1*t1)/den
4620      by=- (t1*yt-y1*t2)/den
4621      az= ( n*zt-z1*t1)/den
4622      bz=- (t1*zt-z1*t2)/den
4623      p(4*k,1)=ax*off(k)*25.4d0+bx
4624      p(4*k,2)=ay*off(k)*25.4d0+by
4625      p(4*k,3)=az*off(k)*25.4d0+bz
4626
4627      enddo
4628      end

```

F77L - Lahey FORTRAN 77, Version 5.01 07 Apr 93 08:59:19

Page 145

SUBROUTINE GETICV Compiling Options:
/NO/N2/N3/N7/NA/A1/NA2/NB/NC/C1/ND/NE/NF/H/I/NK/NL/P/NQ1/R/S/NT/NV/W/NX/NZ1
Source file Listing

```

4629 C*****
4630      SUBROUTINE GETICV(ID2,OBJECT,GPCOV)
4631 C
4632 C Search object point ids to find matching ids of targets on the head,
4633 C mouth and neck. Desired variables are saved.
4634 C
4635      REAL*8      OBJECT(3),GPCOV(3,3),VARH,VARM,VARN,VAR2
4636      CHARACTER*4  VAR
4637 C
4638      COMMON /TAPES/ IN,IO,IOS,IOIC,IDUM(14)
4639      COMMON /CONS/  NH,NM,NN,VARH(24,13),VARM(24,13),VARN(24,13)
4640 C
4641      DIMENSION    IDH(24),IDM(24),IDN(24)
4642 C
4643      DATA IDH /'hrc1','hrc2','hrc3','hrc4',
4644      .          'hrc5','hrc6','hrc7','hrc8',
4645      .          'hcc1','hcc2','hcc3','hcc4',
4646      .          'hcc5','hcc6','hcc7','hcc8',
4647      .          'hlc1','hlc2','hlc3','hlc4',
4648      .          'hlc5','hlc6','hlc7','hlc8'/
4649      DATA IDM /'mrc1','mrc2','mrc3','mrc4',
4650      .          'mrc5','mrc6','mrc7','mrc8',
4651      .          'mcc1','mcc2','mcc3','mcc4',

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Anthropometry and Initial Conditions Photogrammetric Program

```

4652      .      'mcc5','mcc6','mcc7','mcc8',
4653      .      'mlc1','mlc2','mlc3','mlc4',
4654      .      'mlc5','mlc6','mlc7','mlc8'/
4655      DATA IDN /'nrc1','nrc2','nrc3','nrc4',
4656      .      'nrc5','nrc6','nrc7','nrc8',
4657      .      'ncc1','ncc2','ncc3','ncc4',
4658      .      'ncc5','ncc6','ncc7','ncc8',
4659      .      'nlc1','nlc2','nlc3','nlc4',
4660      .      'nlc5','nlc6','nlc7','nlc8'/
4661      C
4662      EQUIVALENCE (VAR,VAR2)
4663      C
4664      DO 40 J=1,24
4665      C
4666      C SAVE MOUTH DATA
4667      C
4668      IF(ID2.EQ.IDM(I)) THEN
4669      C
4670      C ENCODE CHARACTER DATA
4671      WRITE(VAR,50) ID2
4672      C
4673      NM=NM+1
4674      VARM(I,1)=VAR2
4675      VARM(I,2)=OBJECT(1)
4676      VARM(I,3)=OBJECT(2)
4677      VARM(I,4)=OBJECT(3)

```

F77L - Lahey FORTRAN 77, Version 5.01 07 Apr 93 08:59:19

Page 146

SUBROUTINE GETICV Compiling Options:

/NO/N2/N3/N7/NA/A1/NA2/NB/NC/C1/ND/NE/NF/H/I/NK/NL/P/NQ1/R/S/NT/NV/W/NX/NZ1

Source file Listing

```

4678      K=4
4679      DO 10 J=1,3
4680      DO 10 J1=1,3
4681      K=K+1
4682      10 VARM(I,K)=GPCOV(J,J1)
4683      C
4684      C SAVE HEAD DATA
4685      C
4686      ELSE IF(ID2.EQ.IDH(I)) THEN
4687      WRITE(VAR,50) ID2
4688      NH=NH+1
4689      VARH(I,1)=VAR2
4690      VARH(I,2)=OBJECT(1)
4691      VARH(I,3)=OBJECT(2)
4692      VARH(I,4)=OBJECT(3)
4693      K=4
4694      DO 20 J=1,3
4695      DO 20 J1=1,3
4696      K=K+1
4697      20 VARH(I,K)=GPCOV(J,J1)
4698      C
4699      C SAVE NECK DATA
4700      C
4701      ELSE IF(ID2.EQ.IDN(I)) THEN
4702      WRITE(VAR,50) ID2
4703      NN=NN+1
4704      VARN(I,1)=VAR2
4705      VARN(I,2)=OBJECT(1)
4706      VARN(I,3)=OBJECT(2)
4707      VARN(I,4)=OBJECT(3)
4708      K=4
4709      DO 30 J=1,3

```

NAVAL BIODYNAMICS LABORATORY SOFTWARE DOCUMENTATION

```

4710      DO 30 J1=1,3
4711      K=K+1
4712      30      VARN(I,K)=GPCOV(J,J1)
4713      ENDIF
4714      C
4715      40      CONTINUE
4716      C
4717      50      FORMAT(A4)
4718      RETURN
4719      END

```

F77L - Lahey FORTRAN 77, Version 5.01 07 Apr 93 08:59:19

Page 147

SUBROUTINE ICONS Compiling Options:
 /NO/N2/N3/N7/NA/A1/NA2/NB/NC/C1/ND/NE/NF/H/I/NK/NL/P/NQ1/R/S/NT/NV/W/NX/NZ1
 Source file Listing

```

4720      C*****
4721      SUBROUTINE ICONS
4722      C
4723      C Write Initial Conditions data to a file.
4724      C
4725      REAL*8 VARH,VARM,VARN
4726      C
4727      COMMON /TAPES/ IN,IO,IOS,IOIC,IDUM(14)
4728      COMMON /CONS/ NH,NM,NN,VARH(24,13),VARM(24,13),VARN(24,13)
4729      C
4730      CHARACTER*4 TYPE(3)/'MOUT','HEAD','NECK'/
4731      C
4732      C WRITE MOUTH DATA
4733      C
4734      IF(NM.EQ.0) GO TO 20
4735      WRITE(IOIC,100) TYPE(1)
4736      DO 10 I=1,24
4737      IF(VARM(I,1) .EQ. 0) GO TO 10
4738      WRITE(IOIC,100) VARM(I,1)
4739      J1=2
4740      J2=4
4741      DO 5 I1=1,4
4742      WRITE(IOIC,200) (VARM(I,J),J=J1,J2)
4743      J1=J2+1
4744      J2=J2+3
4745      5      CONTINUE
4746      10      CONTINUE
4747      WRITE(IOIC,300)
4748      C
4749      C WRITE HEAD DATA
4750      C
4751      20      IF(NH.EQ.0) GO TO 40
4752      WRITE(IOIC,100) TYPE(2)
4753      DO 30 I=1,24
4754      IF(VARH(I,1) .EQ. 0) GO TO 30
4755      WRITE(IOIC,100) VARH(I,1)
4756      J1=2
4757      J2=4
4758      DO 25 I1=1,4
4759      WRITE(IOIC,200) (VARH(I,J),J=J1,J2)
4760      J1=J2+1
4761      J2=J2+3
4762      25      CONTINUE
4763      30      CONTINUE
4764      WRITE(IOIC,300)
4765      C
4766      C WRITE NECK DATA
4767      C

```

Anthropometry and Initial Conditions Photogrammetric Program

4768 40 IF(NN.EQ.0) GO TO 60

F77L - Lahey FORTRAN 77, Version 5.01 07 Apr 93 08:59:19

Page 148

SUBROUTINE ICONS Compiling Options:

/NO/N2/N3/N7/NA/A1/NA2/NB/NC/C1/ND/NE/NF/H/I/NK/NL/P/NQ1/R/S/NT/NV/W/NX/NZ1

Source file Listing

```
4769      WRITE(IOIC,100) TYPE(3)
4770      DO 50 I=1,24
4771      IF(VARN(I,1) .EQ. 0) GO TO 50
4772      WRITE(IOIC,100) VARN(I,1)
4773      J1=2
4774      J2=4
4775      DO 45 I1=1,4
4776      WRITE(IOIC,200) (VARN(I,J),J=J1,J2)
4777      J1=J2+1
4778      J2=J2+3
4779 45  CONTINUE
4780 50  CONTINUE
4781 60  WRITE(IOIC,300)
4782      WRITE(IOIC,300)
4783  C
4784  C  RESET VARIABLE COUNTERS
4785  C
4786      NH=0
4787      NM=0
4788      NN=0
4789  C
4790 100  FORMAT(A4)
4791 200  FORMAT(3(D11.4,1X))
4792 300  FORMAT('EOEOF')
4793  C
4794      END
```

Bibliography

- Elassal, Atef A. and Malhotra, Roop C., *General Integrated Analytical Triangulation Program (GIANT) User's Guide*, Technical Report NOS126CGS11, U. S. Department of Commerce, National Oceanic and Atmospheric Administration, Rockville, MD, 1987.
- Francis, D.A., *X-ray Anthropometry Digitization Program for the Hewlett-Packard 9000/835 Computer*, NBDL-90R003, Naval Biodynamics Laboratory, New Orleans, LA, 1991.
- GPA Associates, *Manual Of Close-Range Photogrammetric Techniques for the Naval Biodynamics Laboratory*, New Orleans, LA, 1991.